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(54)【発明の名称】 液晶表示素子用補償板の製造法

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## (57)【特許請求の範囲】

【請求項1】配向基板上に形成された液晶性高分子より成る層を、透光性基板上に転写することを特徴とする液晶表示素子用補償板の製造法。

【請求項2】液晶性高分子が液晶状態ではねじれネマチック配向し、液晶転移点以下の温度ではガラス状態となる液晶性高分子であることを特徴とする請求項第1項記載の製造法。

【請求項3】透光性基板がプラスチックフィルムであることを特徴とする請求項第1項記載の製造法。

【請求項4】透光性基板が偏光フィルムであることを特徴とする請求項第1項記載の製造法。

【請求項5】透光性基板が液晶表示セルの上面または／および下面のガラス基板であることを特徴とする請求項第1項記載の製造法。

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## 【発明の詳細な説明】

## (産業上の利用分野)

本発明は液晶ディスプレイの着色を解消し表示を白黒化するために有用な液晶表示素子用補償板の製造法に関する。

## (従来の技術)

液晶ディスプレイは低電圧駆動、軽量、低コストなどの特徴の故に、ディスプレイ分野において大きな地位を占めている。たとえば単純マトリクス駆動方式のスーパーツイステッドネマチック(以下STNと略す)液晶ディスプレイはマルチブレックス駆動ドットマトリクス方式で大画面表示が可能で、従来のツイステッドネマチック(TN)型液晶ディスプレイに比べてコントラストが高くまた視野角が広いなどの特徴があるため、パーソナルコンピューター、ワードプロセッサー、各種データターミ

ナルなど大画面表示を必要とする液晶ディスプレイの分野で広く用いられている。しかしながらSTN方式は、複屈折効果により表示を行うため、黄色や青の着色が避けられなかつた。この着色モードによる表示は使用する側から好まれないばかりでなく、カラー化に対応できないという重大な欠点を有する。

またアクティブマトリクス駆動方式の代表例である薄膜トランジスタ（以下TFTと略す）使用液晶ディスプレイにおいてもその製造の困難さ以外に、応答速度の向上、視角特性の向上などを目的としてセルギャップを薄くしようとすると、同じく着色が生じるという重大な欠点が発生する。

着色モードを白黒モードに変換するために、本来の表示用STN液晶セルの上に、同じセルギャップでねじれ角を逆にしたもう一層の補償用液晶セルを配置することによつて補償するいわゆる2層セル方式が実用化されている。またより簡便な方法として表示用セルに合わせて複屈折特性のみを調節したポリカーボネート延伸フィルムなどの補償用フィルム（位相差フィルム）が開発され一部実用化されている。

しかしながら2層セル方式はかなり品位の高い白黒表示を実現できるものの、コストが高い、重い、厚いなどの大きな欠点を有する。一方位相差フィルム補償方式は安い、軽い、薄い等の長所を持つが、ねじれ構造を待たない一端延伸フィルムであるために位相差のみの補償で旋光分散の補償ができず、肝心の補償性能が不十分で疑似白黒表示が得られるにすぎず、コントラストも2層方式に比べるとかなり低い。

本発明者らはこの両方式の欠点を補うものとして、ねじれネマチック構造を固定化した高分子液晶フィルムより成る液晶表示素子用補償板を先に提案した（特願平1-150550等）。該発明の補償板は配向膜付き透光性基板上に形成された1枚のフィルムに2層セル方式と同等の補償性能を付与せしめた画期的なものであつた。しかしながらこの配向膜付き透光性基板は、製造時には高分子液晶を配向させる役割を有するため配向能のほかに耐熱性、耐溶剤性などが要求される。またこの透光性基板は補償板の構成部材としても使用されるために、透明性、光学的等方性が要求される。この様に従来法では透光性基板に対する要求が厳しく透光性基板の選択の幅が狭まり、結果として補償板の性能、製品形態を制限していた。

#### （発明が解決しようとする課題）

本発明者らは液晶性高分子を用いた当該発明の液晶表示用補償板の有するかかる問題点を解決する手段について鋭意検討した結果、かかる問題点が1枚の配向膜付き透光性基板上に液晶性高分子を配向せしめて補償層を形成し、かつこの配向性基板をそのまま液晶表示素子用補償板の構成部材として使用するために生することに着目した。すなわち液晶性高分子を配向せしめる基板と液晶

表示素子用補償板の構成部材としての支持基板とを分離すれば、前者は透明性、光学的等方性のないものでも使用でき、また後者は耐熱性、耐溶剤性のないものでも使用できることを見だし、ついに本発明を完成した。

#### （発明を解決するための手段）

すなわち本発明は、配向基板上に形成された液晶性高分子より成る補償層を、透光性基板上に転写することを特徴とする液晶表示素子用補償板の製造法に関する。

本発明の好ましい態様としては、液晶性高分子が液晶状態ではねじれネマチック配向し、液晶転移点以下の温度ではガラス状態となる液晶高分子である上記方法、透光性基板がプラスチックフィルムである上記方法、透光性基板が偏光フィルムである上記方法、および透光性基板が液晶表示セルの上面または／および下面のガラス基板である上記方法が挙げられる。

以下本発明について詳細に説明する。

まず、本発明の製造法の概略を第1図に基づいて説明する。本発明においてはまず配向基板（11）上に液晶性高分子を塗布する。次に所定の温度で熱処理を行い液晶性高分子を配向させた後冷却して配向構造を固定化して補償層（12）を形成させる。次にこの補償層の上に接着剤または粘着剤（13）を介して透光性基板（14）を貼り付ける。次に補償層を配向基板と補償層との界面で剥離して、補償層を透光性基板側に転写することにより本発明の液晶表示素子用補償板（15）を製造することができる。

本発明の配向基板とは高分子液晶配向能を有する基板をいい、本発明で用いられる配向基板としては高分子液晶を配向させる能力および所定の耐熱性、耐溶剤性を有し、かつ補償層を剥離できる剥離性を持つものであればすべて使用できる。配向能、要求される耐熱性、耐溶剤性あるいは剥離性は、用いる高分子液晶の種類と性質によつて異なるため一概には言えないが、用いられる配向基板の代表例としては、まずアルミ、鉄、銅などの金属板、陶磁器製の板、ほうろう板、ガラスなどのシート状あるいは板状の基板の上に、公知のラビングしたポリイミド膜、ラビングしたポリビニルアルコール膜あるいは酸化珪素の鍍め蒸着膜などの配向膜を有するものが挙げられる。また他の例としてはポリイミド、ポリアミドイミド、ポリエーテルイミド、ポリアミド、ポリエーテルエーテルケトン、ポリエーテルケトン、ポリケトンサルファイド、ポリエーテルスルフオン、ポリスルフオン、ポリフェニレンサルファイド、ポリフェニレンオキサイド、ポリエチレンテレフタレート、ポリブチレンテレフタレート、ポリアセタール、ポリカーボネート、アクリル樹脂、ポリビニルアルコール、セルロース系プラスチック、エボキシ樹脂、フエノール樹脂などのプラスチックフィルムまたはシート表面を直接ラビング処理した基盤、あるいはこれらのフィルムまたはシート上にラビングしたポリイミド膜、ラビングしたポリビニルアルコ

ール膜などの配向膜を有する基板などを挙げることができる。またこれらのプラスチックフィルムまたはシートの内結晶性の高いものについては1軸延伸するだけで高分子液晶の配向能を持つものもあり、それらについては直接ラビング処理またはラビングポリイミド配向能を付けることをせずともそのまま配向基板として用いることができる。例としてはポリイミド、ポリエーテルイミド、ポリエーテルエーテルケトン、ポリエーテルケト、ポリフェニレンサルファイト、ポリエチレンテレフタレートなどを挙げることができる。

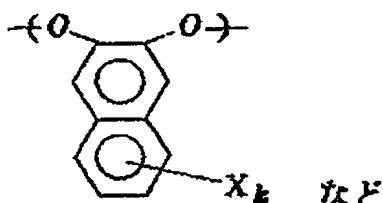
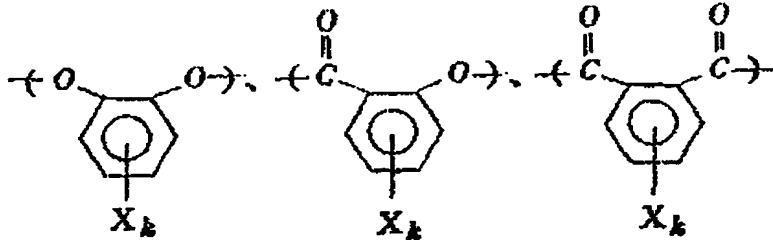
これらの中でもガラスあるいは金属板上にラビングポリイミド層またはラビングポリビニルアルコール層を有する配向基板、ポリイミド、ポリエチレンテレフタレート、ポリフェニレンサルファイト、ポリエーテルエーテルケトン、ポリビニルアルコール等のフィルムあるいはシートを直接ラビングした配向基板等が特に好ましい。

これらの配向基板上に液晶性高分子を塗布、乾燥、熱処理し、均一でモノドメインなねじれネマチック構造を形成させたのち冷却して、液晶状態における配向を損なうことなく固定化することによりまず補償層を配向基板上に形成する。本発明で用いられる液晶性高分子は、均一でモノドメインなねじれネマチック配向性を示しかつその配向状態を容易に固定化できる液晶性高分子に所定量の光学活性化合物を加えた組成物、または均一でモノドメインなねじれネマチック配向性を示しかつその配向状態を容易に固定化できる液晶性高分子である。

まず前者のネマチック液晶性高分子と光学活性化合物による組成物について説明すると、ベースとなる均一でモノドメインなネマチック配向性を示しかつその配向状態を容易に固定化できる液晶性高分子は、以下のようない性質を有することが必須である。ネマチック配向の安\*

\* 定した固定化を行うためには、液晶の相系列でみた場合、ネマチック相より低温部に結晶相を持たないことが重要である。これらの相が存在する場合固定化のために冷却するとき必然的にこれらの相を通過することになり、結果的に一度得られたネマチック配向が破壊されてしまい、透明性、結晶効果共に不満足なものになってしまふ。したがつて本発明の補償板を作製するためには、ネマチック相より低温部にガラス相を有する液晶性高分子を用いることが必須である。これらのポリマーに光学活性化合物を加えることにより、液晶状態ではねじれネマチック配向をし、液晶転移点以下ではガラス相をとるために、ねじれネマチック構造を容易に固定化できる。

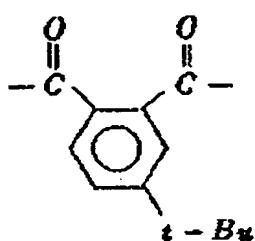
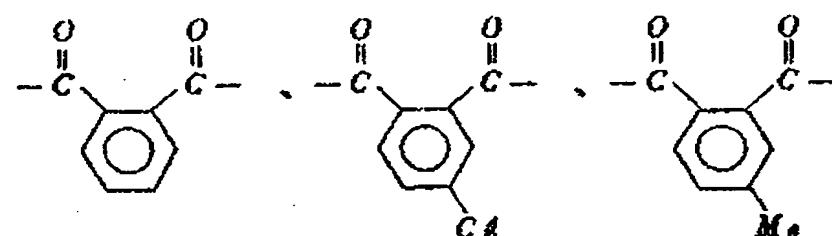
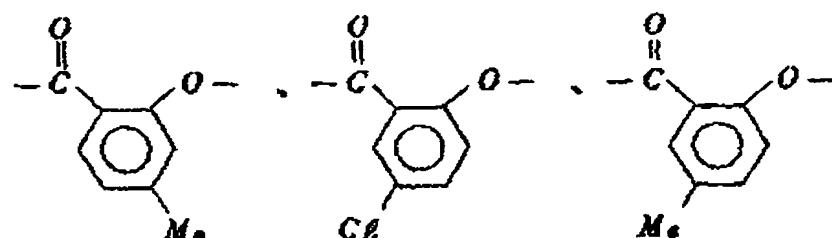
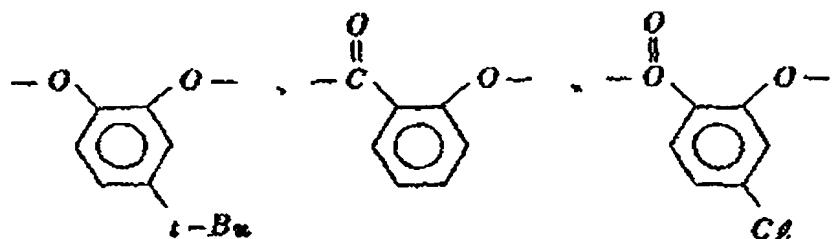
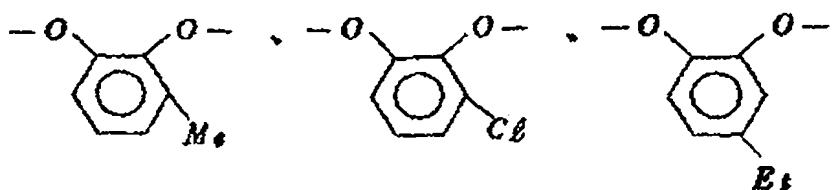
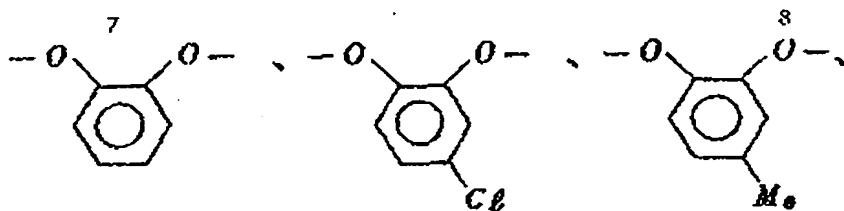
用いられるポリマーの種類としては、液晶状態でネマチック配向し、液晶転移点以下ではガラス状態となるものはすべて使用でき、例えばポリエステル、ポリアミド、ポリカーボネート、ポリエスチルイミドなどの主鎖型液晶ポリマー、あるいはポリアクリレート、ポリメタクリレート、ポリマロネート、ポリシロキサンなどの側鎖型液晶ポリマーなどを例示することができる。なかでも合成の容易さ、透明性、配向性、ガラス転移点などからポリエステルが好ましい。用いられるポリエステルとしてはオルソ置換芳香族単位を構成成分として含むポリマーが最も好ましいが、オルソ置換芳香族単位の代わりにかさ高い置換基を有する芳香族、あるいはフッ素または含フッ素置換基を有する芳香族などを構成成分として含むポリマーもまた使用することができる。本発明で言うオルソ置換芳香族単位とは、主鎖をなす結合を互いにオルソ位とする構造単位を意味する。具体的には次に示すようなカテコール単位、サリチル酸単位、フタル酸単位およびこれらの基のベンゼン環に置換基を有するものなどをあげることができる。



49 (Xは水素、Cl、Br等のハロゲン、炭素数が1から4のアルキル基もしくはアルコキシ基またはフェニル基を示すまたkは0~2である。)

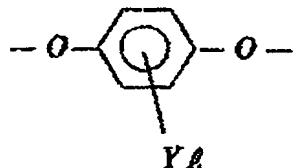
これらのなかでも特に好ましい例として次のようなものを例示することができる。

(4)



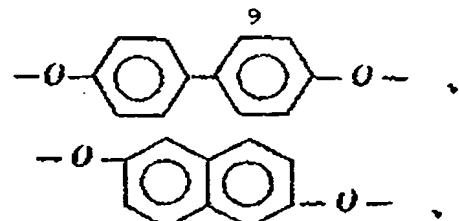
下、オキシカルボン酸成分という)を構成成分として含み、好ましくは、前記オルソ置換芳香族単位を含むポリマーが例示できる。

40 これらのうち、ジオール成分としては次のような芳香族および脂肪族のジオールを挙げることができる。

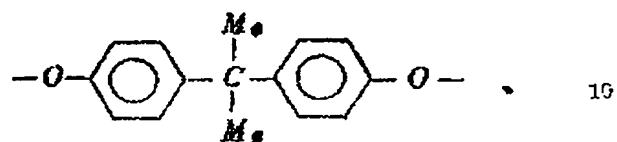
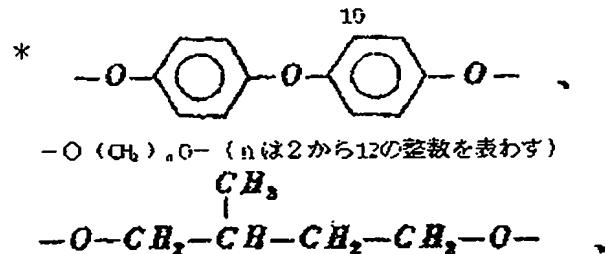


本発明で好ましく用いられるポリエステルとしては  
(a) ジオール類より誘導される構造単位(以下、ジオール成分といふ)およびジカルボン酸類より誘導される構造単位(以下、ジカルボン酸成分といふ)および/または(b) 一つの単位中にカルボン酸と水酸基を同時に含むオキシカルボン酸類より誘導される構造単位(以

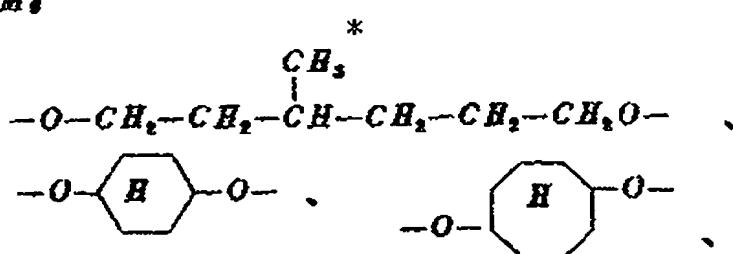
(Yは水素、Cl、Br等のハロゲン炭素数1から4のアルキル基もしくはアルコキシまたはフェニル基を示す。!)  
50 は0~2である。),



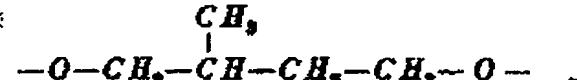
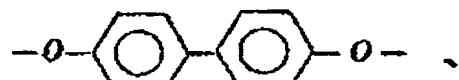
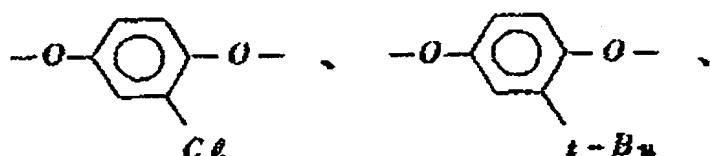
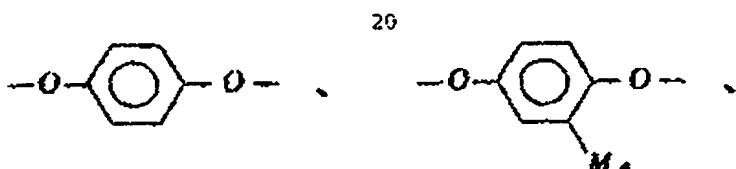
(5)



19



三九



$$= 0 = \text{tr}(\alpha) = 0 = \dots = 0 \quad (\text{by } \star), \quad 0 =$$

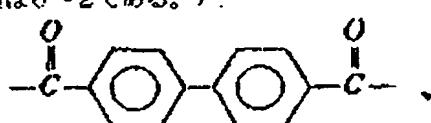
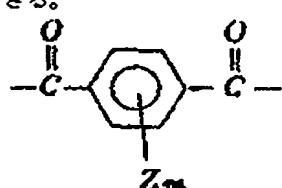
X



(乙は水素、Cl、Br等のハロゲン、炭素数が1から4のアルキル基もしくはアルコキシ基またはフェニル基を示す。) (1) は(2) である。

などが好ましく用いられる(式中、Mはメチル基、B<sub>n</sub>はブチル基を示す)。

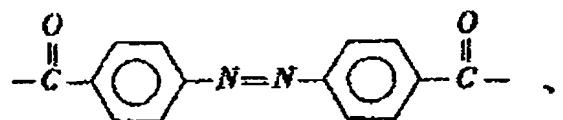
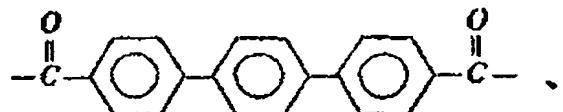
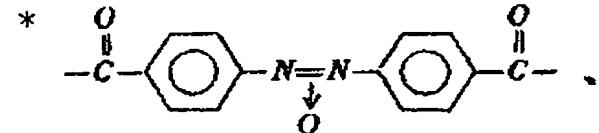
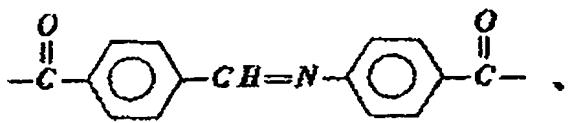
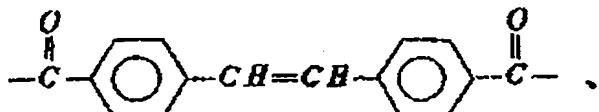
またシカルボン酸成分としては次のようなものを例示 49



(6)

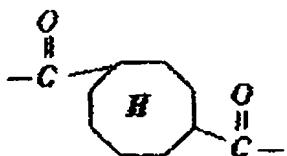
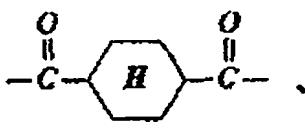
12

11

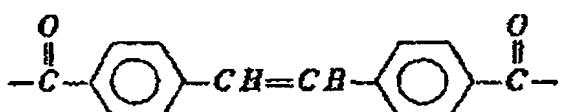
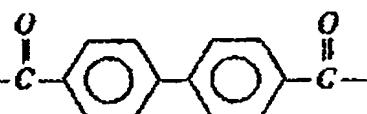
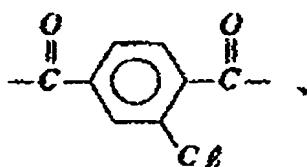
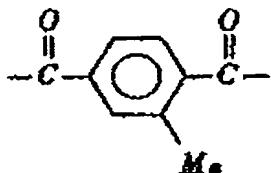
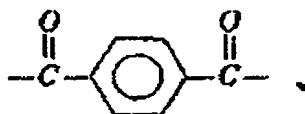


16

\*



なかでも、

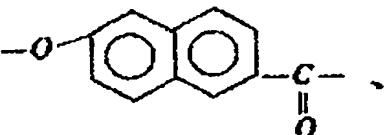
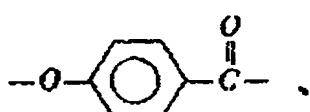


※などが好ましい。

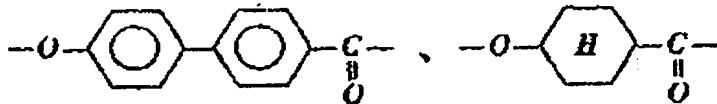
オキシカルボン酸成分としては、具体的には次のように  
な単位を例示することができる。

49

※



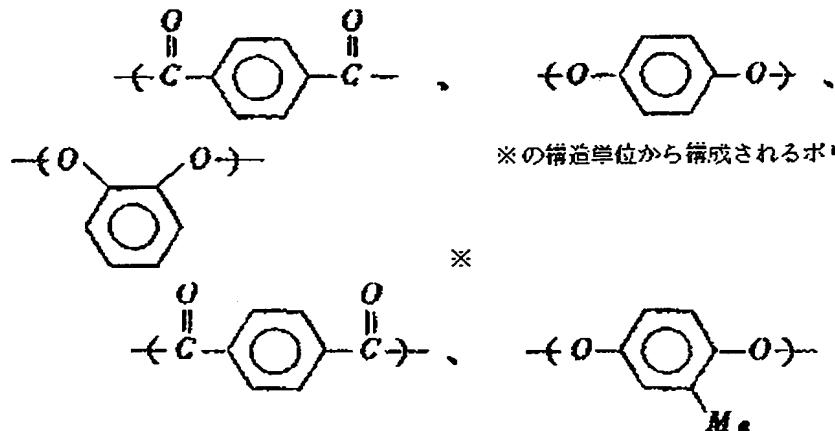
13



14

シカルボン酸とジオールのモル比は、一般的のポリエステルと同様、大略1:1である（オキシカルボン酸を用いている場合は、ガルボン酸基と水酸基の割合）。またポリエステル中に占めるオルソ置換芳香族単位の割合は5モル%から40モル%の範囲が好ましく、さらに好ましくは10モル%から30モル%の範囲である。5モル%より少\*

\*ない場合は、ネマチック相の下に結晶相が現れる傾向があり好ましくない。また40モル%より多い場合は、ポリマーが液性を示さなくなる傾向があり好ましくない。代表的なポリエステルとしては次のようなポリマーを例示することができる。



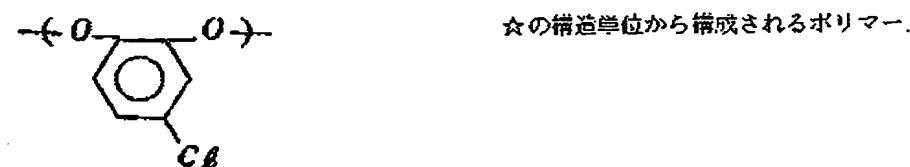
\*の構造単位から構成されるポリマー。

\*

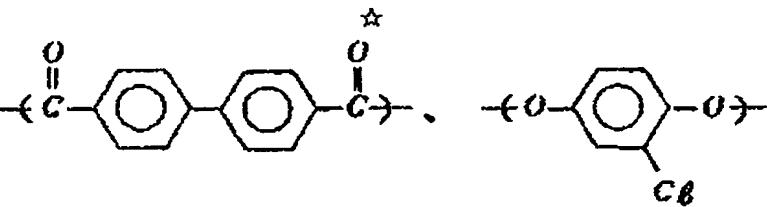


★の構造単位から構成されるポリマー。

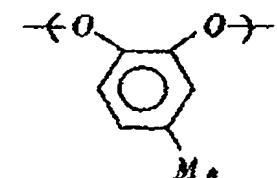
★

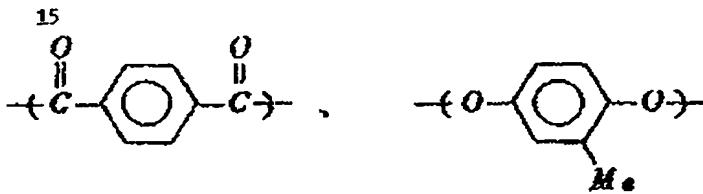


★の構造単位から構成されるポリマー。

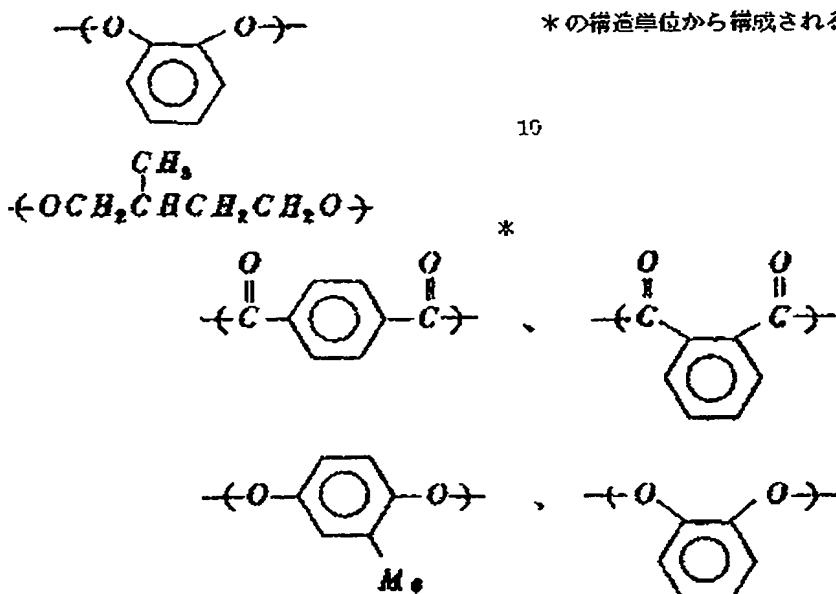


の構造単位から構成されるポリマー。

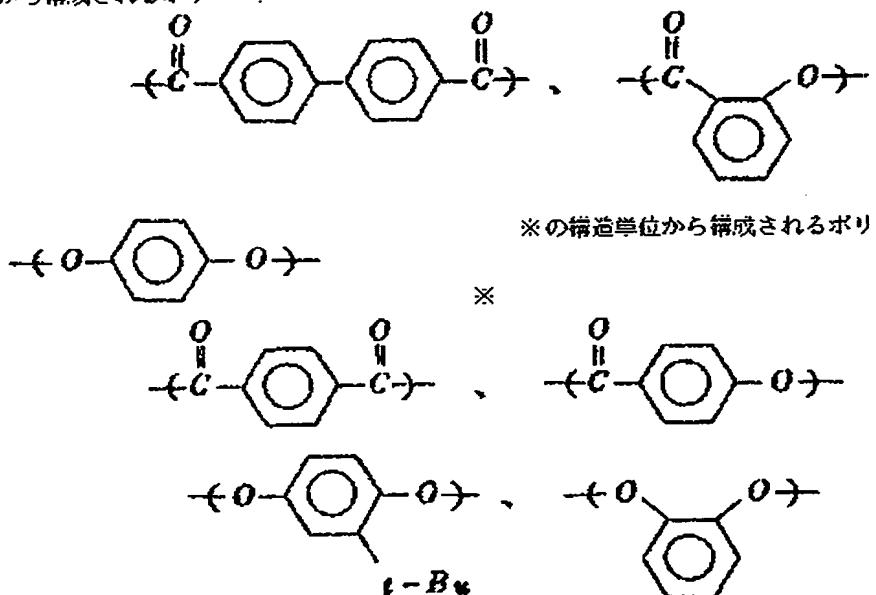




\*の構造単位から構成されるポリマー。



の構造単位から構成されるポリマー。



\*の構造単位から構成されるポリマー。

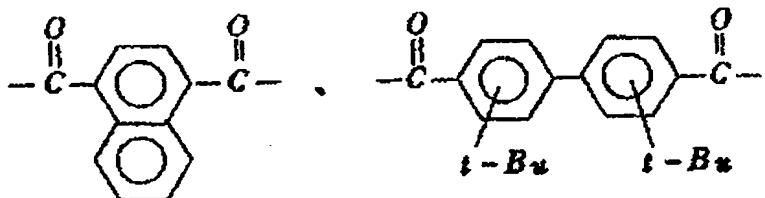
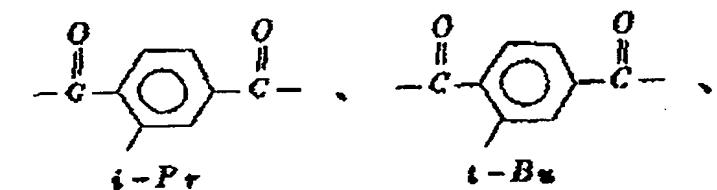
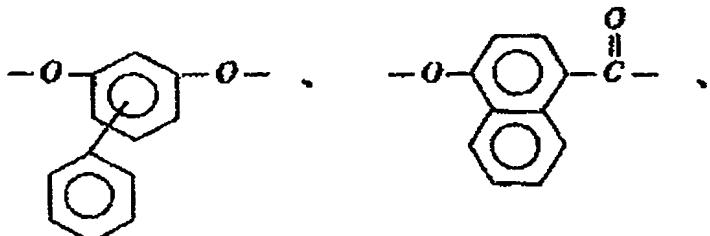
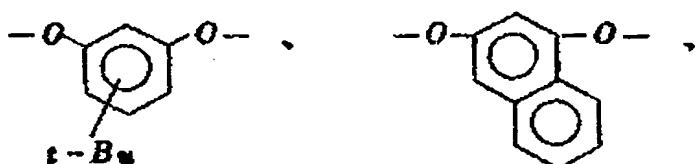
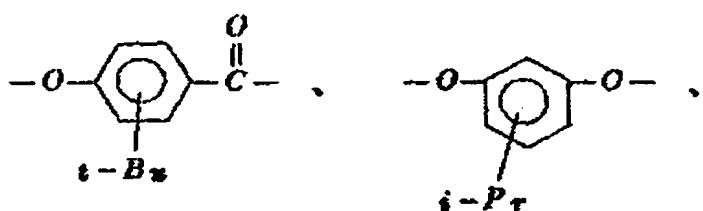
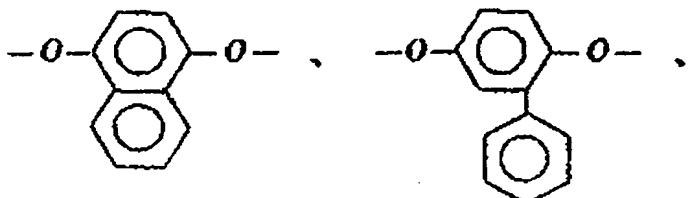
の構造単位から構成されるポリマー。

オルソ置換芳香族単位に変えて次に示すようなかさ高い置換基を含む芳香族単位、あるいはフッ素または含フ

ッ素置換基を含む芳香族単位を構成成分とするポリマーもまた好ましく用いられる。

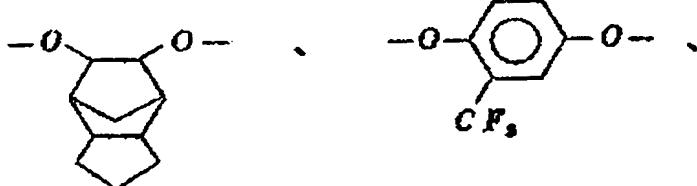
四

18

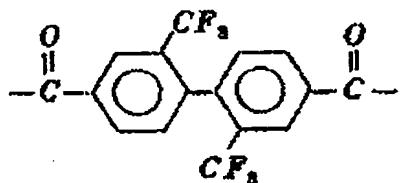
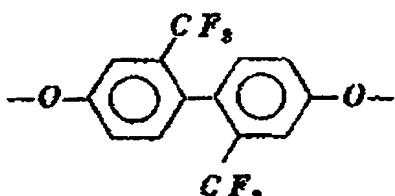
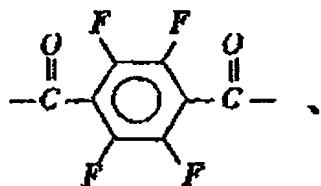
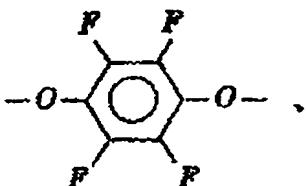
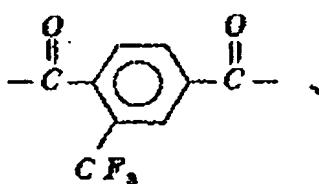
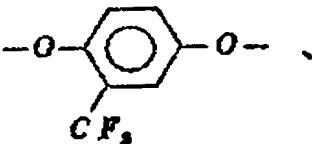


(10)

19



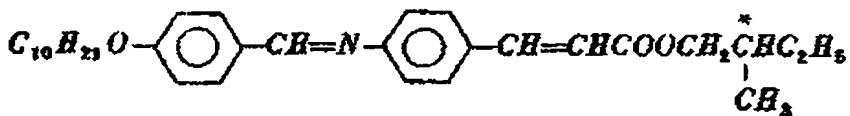
20



これらのポリマーの分子量は、各種溶媒中たとえばフェノール／テトラクロロエタン（60/40重量比）混合溶媒中、30°Cで測定した対数粘度が0.05から3.0、が好ましく、さらに好ましくは0.07から2.0の範囲である。対数粘度が0.05より小さい場合、得られた高分子液晶の強度が弱くなり好ましくない。また3.0より大きい場合、液晶形成時の粘性が高すぎて、配向性の低下や配向に要する時間の増加など問題点が生じる。またこれらポリエステルのガラス転移点も重要であり、配向固定化した後の配向の安定性に影響を及ぼす。用途にもよるが、一般的には室温付近で使用すると考えれば、ガラス転移点が30°C以上であることが望ましく、特に50°C以上であることが望ましい。ガラス転移点が30°Cよりも低い場合、室温付近で使用すると一度固定化した液晶構造が変化する場合があり、液晶構造に由来する機能が低下してしまい好ましくない。

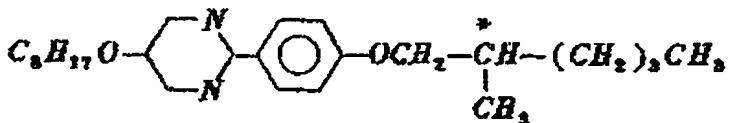
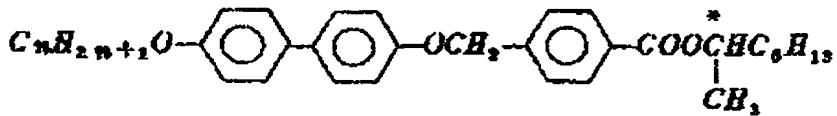
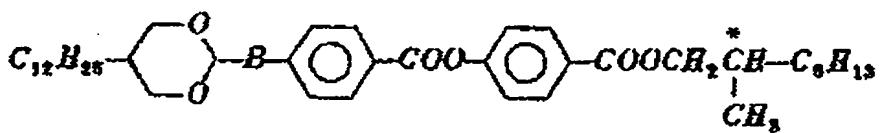
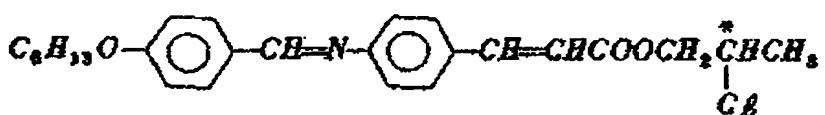
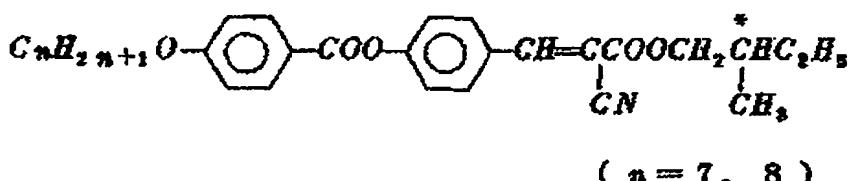
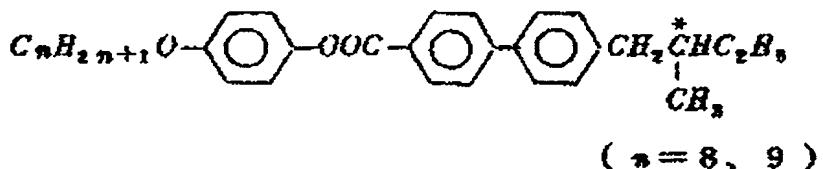
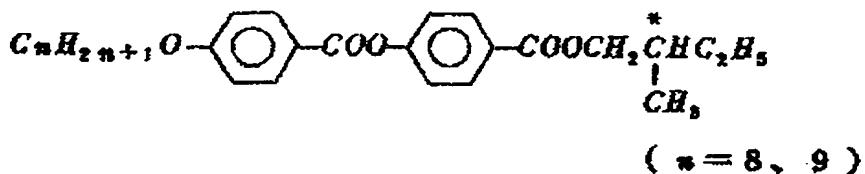
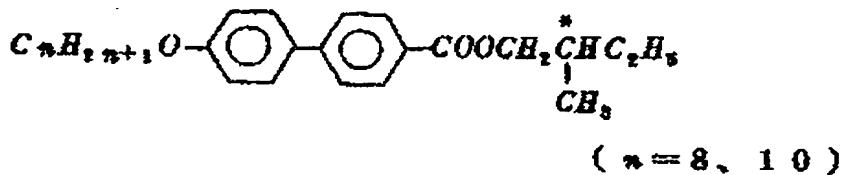
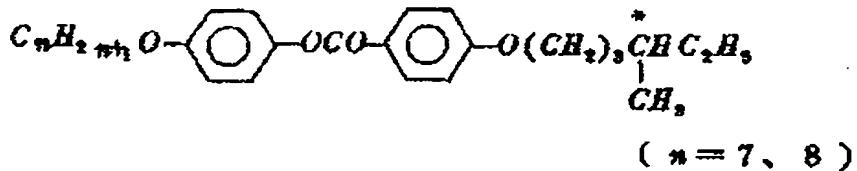
\* これらポリマーの合成法は特に制限されるものではなく、当該分野で公知の重合法、例えば溶融重合法あるいは対応するジカルボン酸の酸クロライドを用いる酸クロライド法で合成される。溶融重合法で合成する場合、例えば対応するジカルボン酸と対応するジオールのアセチル化物を、高温、高真空中で重合させることによつて製造でき、分子量は重合時間のコントロールあるいは仕込組成のコントロールによつて容易に行える。重合反応を促進させるためには、従来から公知の酢酸ナトリウムなどの金属塩を使用することもできる。また溶液重合法を用いる場合は、所定量のジカルボン酸ジクロライドとジオールとを溶媒に溶解し、ビリジンなどの酸受容体の存在下に加热することにより、容易に目的のポリエステルを得ることができる。

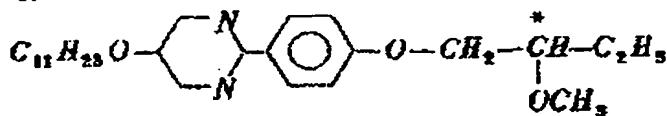
これらネマチック液晶性ポリマーにねじれを与えるために混合される光学活性化合物について説明すると、代表的な例としてまず光学活性な低分子化合物をあげることができる。光学活性を有する化合物であればいずれも本発明に使用することができるが、ベースポリマーとの相溶性の観点から光学活性な液晶性化合物であることが望ましい。具体的には次のような化合物を例示することができる。



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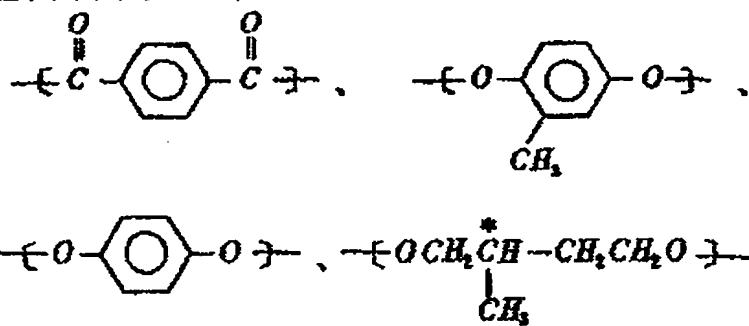




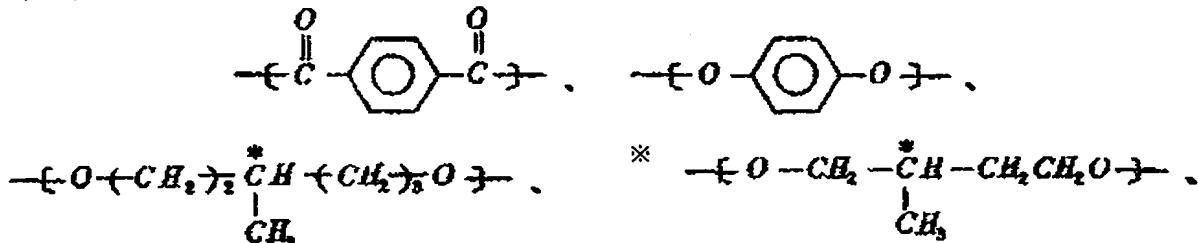
コレステロール誘導体、など。

本発明で用いられる光学活性化合物として、次に光学活性な高分子化合物をあげることができる。分子内に光学活性な基を有する高分子であればいずれも使用することができます。たとえば、ベースポリマーとの相溶性の観点から液晶性を示す高分子であることが望ましい。例として光学活性な基を有する液晶性のポリアクリレート、ポリメタ\*

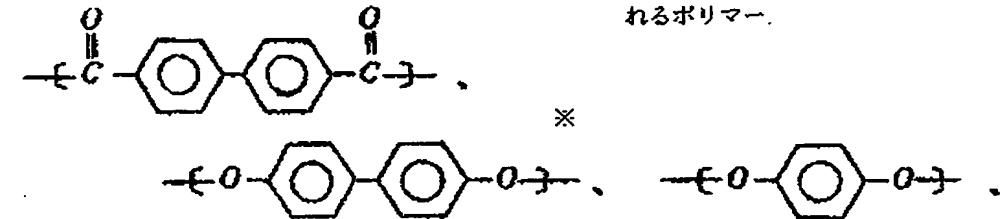
\*クリレート、ポリマロネート、ポリシロキサン、ポリエスチル、ポリアミド、ポリエステルアミド、ポリカーボネート、あるいはポリベブチド、セルロースなどをあげることができる。なかでもベースとなるネマチック液晶性ポリマーとの相溶性から、芳香族主体の光学活性なポリエスチルが最も好ましい。具体的には次のようなポリマーを例示することができます。



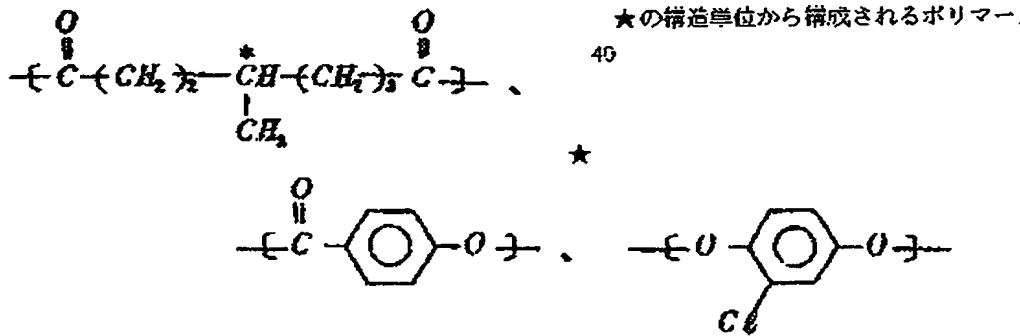
の構造体から構成されるポリマー、



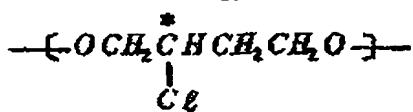
の構造単位から構成されるポリマー、



★の構造単位から構成されるポリマー、



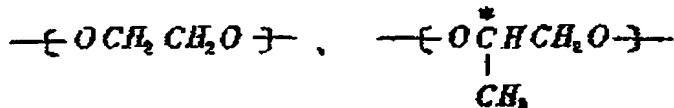
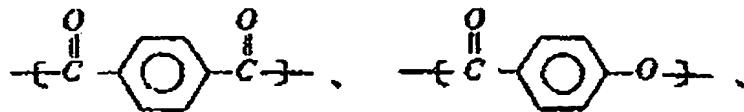
25



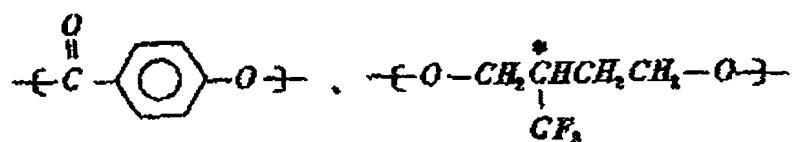
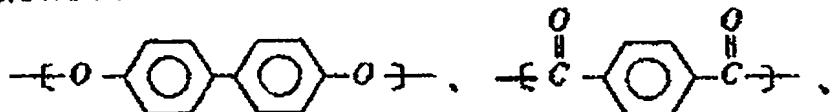
20

\*の構造単位から構成されるポリマー

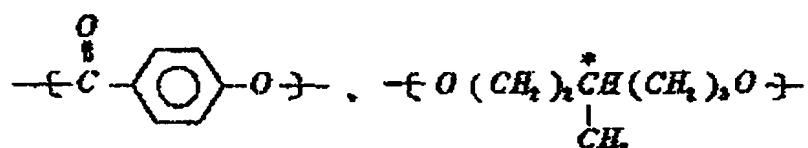
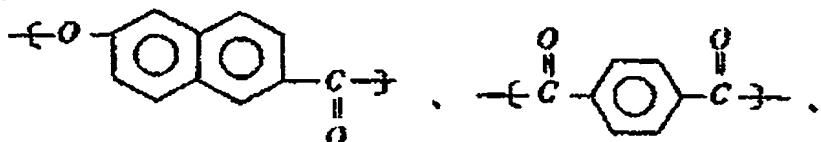
\*



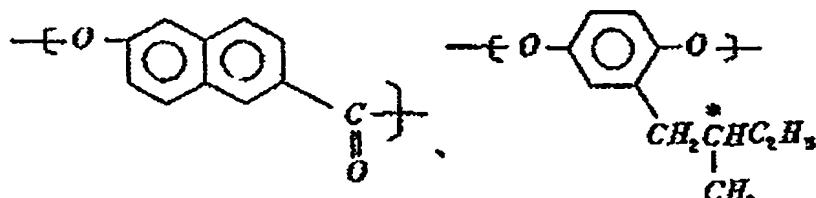
の構造単位から構成されるポリマー。



の構造単位から構成されるポリマー。



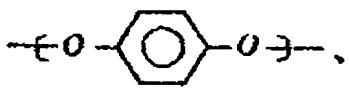
の接着部位から構成されるポリマー



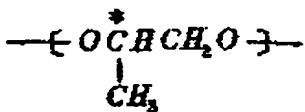
の構造部位から構成されるポリマー



27

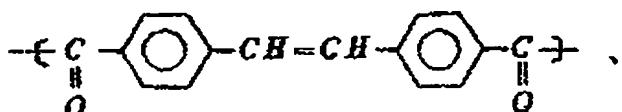


28



\*の構造単位から構成されるポリマー。

\*



の構造単位から構成されるポリマー。

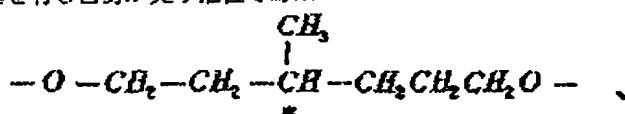
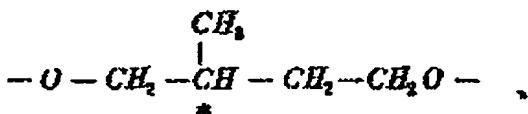
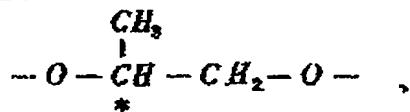
これらのポリマー中に占める光学活性な基の割合は通常0.5モル%~80モル%であり、好みしくは5モル%~60モル%が望ましい。

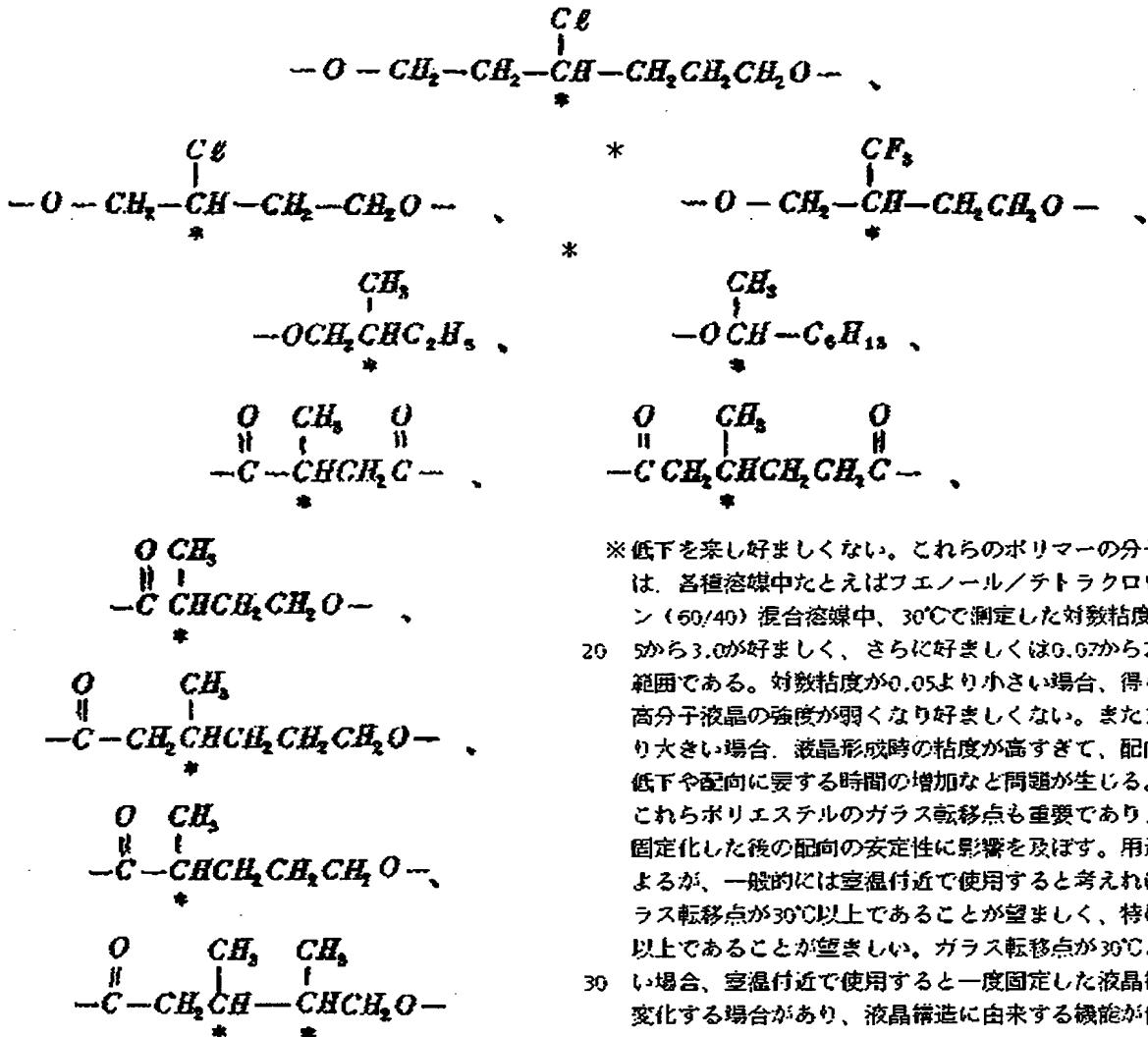
また、これらのポリマーの分子量は、たとえばフェノール/テトラクロロエタン中、30°Cで測定した対数粘度が0.05から5.0の範囲が好ましい。対数粘度が5.0より大きい場合は活性が高すぎて結果的に配向性の低下を招くので好きしくなく、また0.05より小さい場合は組成のコントロールが難しくなり好ましくない。

これらの組成物の調製は、ネマチック液晶性ポリエステルと光学活性化合物を所定の割合で、固体混合、溶液混合あるいはメルト混合などの方法によつて行える。組成物中に占める光学活性化合物の割合は、光学活性化合物中の光学活性な基の比率、あるいはその光学活性化合物のネマチック液晶にねじれを与えるときのねじれ力によつて異なるが、一般的には0.1から50wt%の範囲が好ましく、特に0.5から30wt%の範囲が好ましい。0.1wt%より少ない場合はネマチック液晶に十分なねじれを与えることができず、また50wt%より多い場合は配向性に悪影響をおよぼす。

本発明の結晶板はまた、他の光学活性化合物を用いることなく自身で均一でモノドメインなねじれネマチック配向をし、かつその配向状態を容易に固定化できる高分子液晶を用いることによつても製造できる。これらのポリマーは主鎖中に光学活性基を有し自身が光学活性である。

※ことが必須であり、具体的には光学活性なポリエステル、ポリアミド、ポリカーボネート、ポリエスチルイミドなどの主鎖型液晶ポリマー、あるいはポリアクリレート、ポリメタクリレート、ポリシロキサンなどの側鎖型液晶ポリマーなどを例示することができる。なかでも合成の容易さ、配向性、ガラス転移点などからポリエステルが好ましい。用いられるポリエステルとしてはオルソ置換芳香族単位を構成成分として含むポリマーが最も好ましいが、オルソ置換芳香族単位の代わりにかさ高い置換基を有する芳香族、あるいはフッ素または含フッ素置換基を有する芳香族などを構成成分として含むポリマーもまた使用することができる。これらの光学活性なポリエステルは、今まで説明してきたネマチック液晶性ポリエステルに、さらに光学活性なジオール、ジカルボン酸、オキシカルボン酸を用いて次に示すような光学活性基を導入することにより得られる（式中、\*印は光学活性炭素を示す）



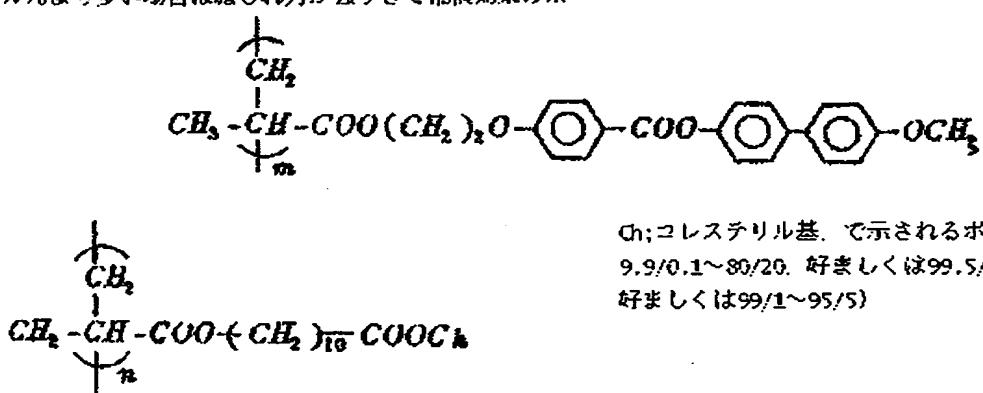


※低下を楽しむましくない。これらのポリマーの分子量は、各種溶媒中たとえばエノール／テトラクロロエタン(60/40)混合溶媒中、30°Cで測定した対数粘度が0.0 20 から3.0が好ましく、さらに好ましくは0.07から2.0の範囲である。対数粘度が0.05より小さい場合、得られた高分子液晶の強度が弱くなり好ましくない。また3.0より大きい場合、液晶形成時の粘度が高すぎて、配向性の低下や配向に要する時間の増加など問題が生じる。またこれらポリエステルのガラス転移点も重要であり、配向固定化した後の配向の安定性に影響を及ぼす。用途によるが、一般的には室温付近で使用すると考えれば、ガラス転移点が30°C以上であることが望ましく、特に50°C以上であることが望ましい。ガラス転移点が30°Cより低い場合、室温付近で使用すると一度固定した液晶構造が変化する場合があり、液晶構造由来する機能が低下してしまい好ましくない。

これらのポリマーの重合は前述した溶融重合法、あるいは酸クロイド法を用いることによつて行うことができる。

以上述べてきた本発明の液晶性高分子の代表的な例としては、具体的には、

など。  
これら光学活性な基のポリマー中に占める割合は、0.1から20モル%の範囲が好ましく、特に0.5から10モル%の範囲が好ましい。光学活性な基の割合が0.1%より少ない場合はねじれ板に必要なねじれ構造が得られず、また20モル%より多い場合はねじれ力が強すぎて従来効果の※

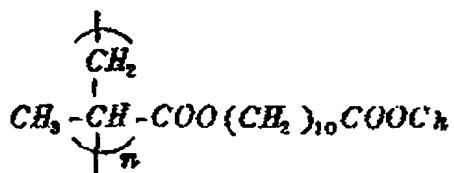
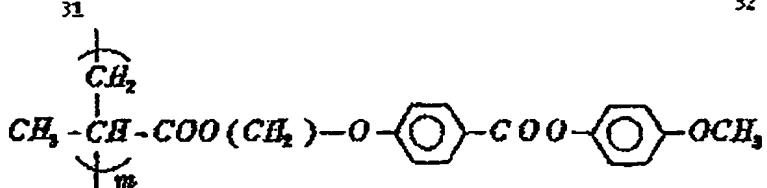


$\text{C}_6$ :コレステリル基、で示されるポリマー(m/n=通常9.9/0.1~80/20、好ましくは99.5/0.5~90/10、さらに好ましくは99/1~95/5)

(16)

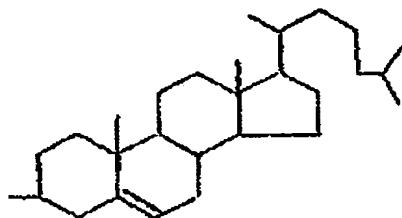
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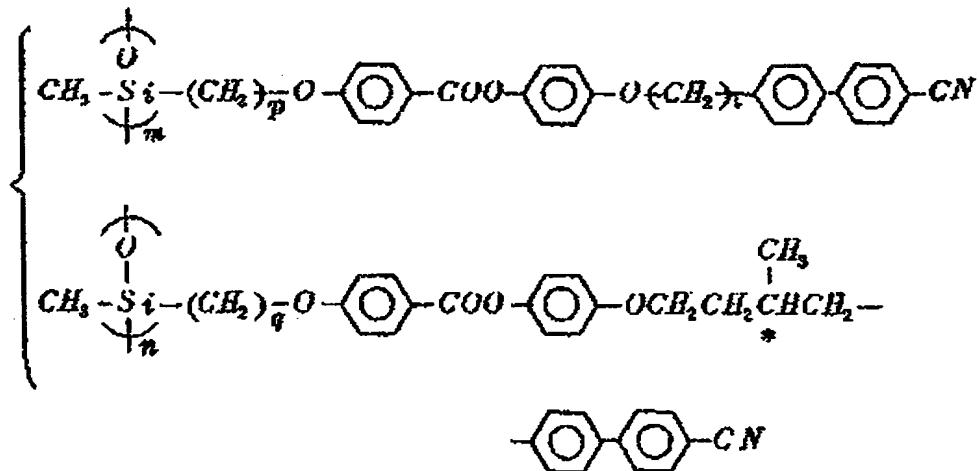
Ch:



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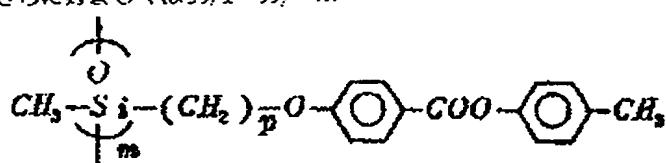
コレステリル基

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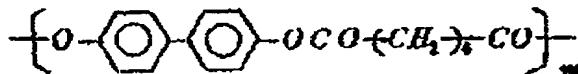
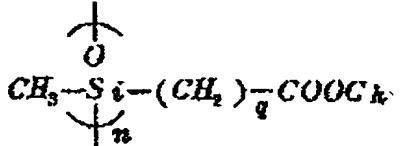


で示されるポリマー (m/n=通常99.9/0.1~20/30. 好ましくは99.5/0.5~90/10. さらに好ましくは99/1~95/5)

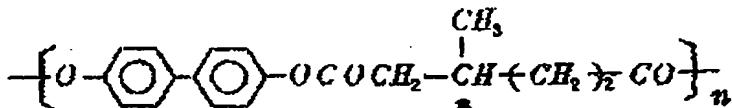
※ 5, p, q; 2~20の整数)



しくは99.5/0.5~90/10. さらに好ましくは99/1~95/5. p, q; 2~20の整数)

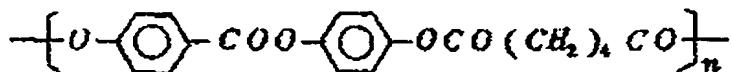
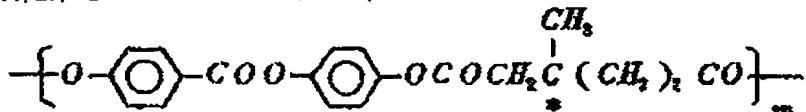


で示されるポリマー (m/n=通常99.9/0.1~20/30. 好ましくは99/1~95/5)

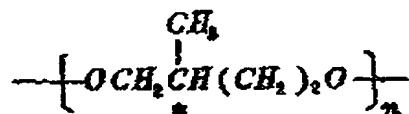
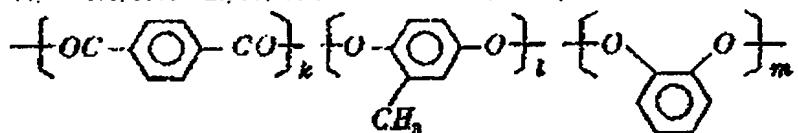


で示されるポリマー ( $m/n=$ 通常、99.9/0.1~80/20、好  $\star$  5)

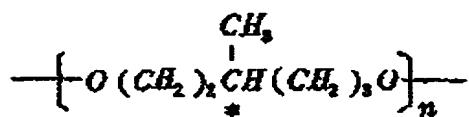
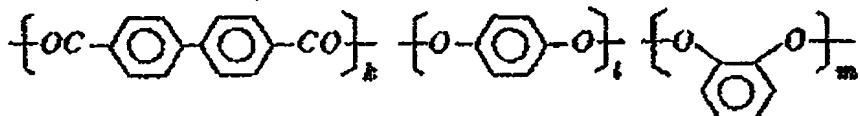
ましくは99.5/0.5~90/10、さらに好ましくは99/1~95/\*



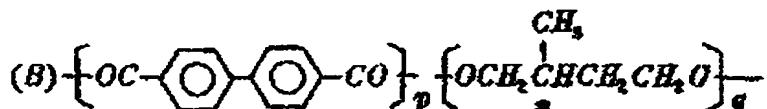
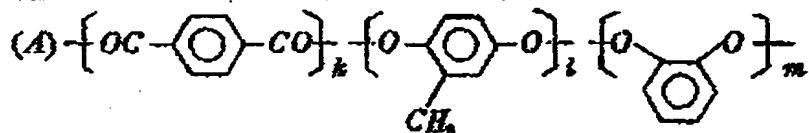
で示されるポリマー ( $m/n=0.5/99.5\sim10/90$ 、好ましく $\star$   $\star$ は1/99~5/95)



で示されるポリマー ( $k=1+m+n$ ,  $k/n=99.5/0.5$   $\star$   $\star$ ~90/10、好ましくは、99/1~95/5,  $1/m=5/95\sim95/5$ )



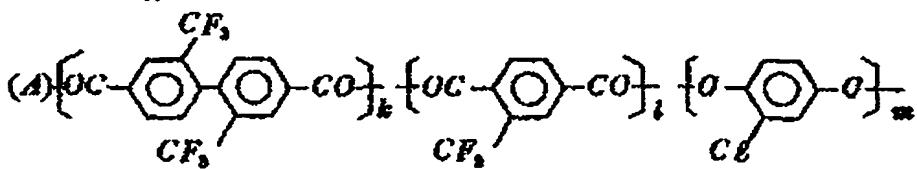
で示されるポリマー ( $k=1+m+n$ ,  $k/n=99.5/0.5$   $\star$   $\star$ ~90/10、好ましくは、99/1~95/5,  $1/m=5/95\sim95/5$ )



で示されるポリマー混合物 ((A) / (B) = 通常99.9/0.1~80/20 (重合比)、好ましくは99.5/0.5~85/5。さらに好ましくは99/1~95/5,  $k=1+m$ ,  $1/m=75/25\sim25/75$ ,  $p=q+r$ ,  $p/q=80/20\sim20/80$ )

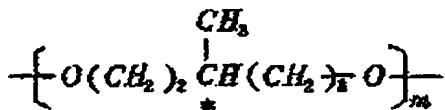
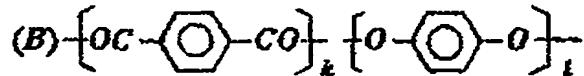
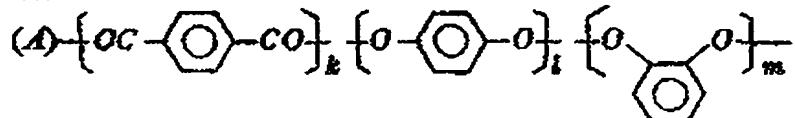
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(B) コレスチリルベンゾエート

で示されるポリマー混合物 ((A)/(B)=通常99.9\*)

\*/0.1~70/30重量比、好ましくは99.5/0.5~80/20、好ましくは99/1~90/10、 $m=k+1$ 、 $k/l=80/20\sim20/80$ )で示されるポリマー混合物 ((A)/(B)=通常99.9/0.1~70/30(重量比)、好ましくは99.5/0.5~80/20、好ましくは99/1~90/10、 $K=1+m$ 、 $1/m=25/75\sim75/25$ 、 $p=q+r$ 、 $q/r=20/80\sim80/20$ )

(なほ、\*印は光学活性炭素を示す)

などが挙げられる。

これらのポリマーの分子量は、各種溶媒中たとえばテトラヒドロフラン、アセトン、シクロヘキサン、フェノール/テトラクロロエタン(60/40)混合溶媒などで、30°Cで測定した対数粘度が0.05から3.0、が好ましく、さらに好ましくは0.07から2.0の範囲である。対数粘度が0.05より小さい場合、得られた高分子液晶の強度が弱くなり好ましくない。また3.0より大きい場合、液晶形成時の粘性が高すぎて、配向性の低下や配向に要する時間の増加など問題が生じる。

次に配向基板上に偏光層を形成する方法についてさらに詳しく説明する。まず用いる高分子液晶の種類に応じて配向基板を選ぶことが重要である。すなわち、前述したように、液晶性高分子溶液を調製するために用いる溶媒に侵されず、熱処理するときの温度に耐えられる配向基板を選ぶ必要がある。また後の転写工程においては偏光層をこの配向基板から剥離するため適度な剥離性を有することが望ましい。

これらの配向基板としては既に前述したが、たとえばポリエステル系液晶性高分子を用いるときの例では、直接ラビングしたポリイミド、ポリエーテルエーテルケトン、ポリフェニレンサルファイト、ポリエチレンテレフタレートのフィルムまたはシートなどがこれらの性質を満足させ好ましい。

液晶性高分子としてマネチック液晶性ポリマーと光学

活性化合物よりなる組成物を用いる場合には、溶媒混合の場合を例にとると、まず両成分を所定の割合で溶媒に溶解し所定濃度の溶液を調製する。また高分子液晶組成物の代わりに自身でねじれネマチック配向性を示す光学活性ポリマーを用いる場合は、単独で所定の溶媒に所定濃度で溶解し溶液を調製する。この際の溶媒はポリマーの種類によつて異なるが、通常はアセトン、メチルエチルケトン、シクロヘキサンなどのケトン類、テトラヒドロフラン、ジオキサンなどのエーテル類、クロロホルム、シクロロエタン、テトラクロロエタン、トリクロロエチレン、テトラクロロエチレン、オルソジクロロベンゼンなどのハログン化炭化水素、これらとフェノールとの混合溶媒、ジメチルホルムアミド、ジメチルアセトアミド、ジメチルスルホキシドなどを用いることができる。溶液の濃度はポリマーの粘性によつて大きく異なるが、通常は5から50wt%の範囲で使用され、好ましくは10から30%の範囲である。この溶液を次に配向基板上に塗布する。塗布法としては、スピンドルコート法、ロールコート法、プリント法、カーテンコート法、浸漬引き上げ法などを採用できる。塗布後溶媒を乾燥により除去し、所定温度で所定時間熱処理してモノドメインなねじれネマチック配向を完成させる。界面効果による配向を助ける意味でポリマーの粘性は低いほうが良く、したがつて温度は高いほうが好ましいが、あまり温度が高いとコストの増大と作業性の悪化を招き好ましくない。またポリマーの種類によつては、ネマチック相より高温部に等方相を有するので、この温度域で熱処理しても配向は得られない。以上のようにそのポリマーの特性にしたがい、ガラス転移点以上で等方相への転移点以下の温度で熱処理することが好ましく、一般的には50°Cから300°Cの範

図が好適で、特に100°Cから250°Cの範囲が好適である。配向膜上で液晶状態において十分な配向を得るために必要な時間は、ポリマーの組成、分子量によって異なり一概にはいえないが、通常10秒から100分の範囲が好ましく、特に30秒から60分の範囲が好ましい。10秒より短い場合は配向が不十分となり易く、また100分より長い場合は得られる補償板の透明性が低下することがある。またポリマーを溶融状態で、配向基板上に塗布したのち熱処理をすることによつても、同様の配向状態を得ることができる。本発明の高分子液晶を用いてこれらの処理を行うことによつて、まず液晶状態で配向基板上全面にわたつて均一なねじれネマチック配向を得ることができ。この時のねじれ角あるいはねじれの方向は、ポリマー中の光学活性単位の種類および比率あるいは混合する光学活性化合物の種類あるいは層を調節することによつて調製することができる。

こうして得られた配向状態を、次に該液晶性高分子のガラス転移点以下の温度に冷却することによつて、配向を全く損なわずに固定化できる。一般的に液晶相より低温部に結晶相を持つているポリマーを用いた場合、液晶状態における配向は冷却することによつて壊れてしまう。本発明の方針によれば、液晶相の下にガラス相を有するポリマー系を使用するためにそのような現象が生ずることなく、完全にねじれネマチック配向を固定化することができる。

冷却速度は特に制限ではなく、加热雰囲気中からガラス転移点以下の雰囲気中に出すだけで固定される。また生産の効率を高めるために、空冷、水冷などの強制冷却を行つても良い。固定化後の補償層の膜厚は通常0.1μmから100μmまでの範囲が好ましく、特に0.5μmから50μmまでの範囲が好ましい。膜厚が0.1μmより小さいと、必要なねじれ角および△n · d が得られず、100μmを超えると配向膜の効果も弱くなり、均一な配向が得られにくくなる。

本発明の補償板が十分な補償効果を發揮し、品質の高い白黒表示を得るために、この補償層の光学バラメータの厳密な制御が重要であり、補償層を構成する分子が基板と垂直方向にらせん軸を有するらせん構造をなし、そのねじれ角が70度から300度の範囲にあり、該液晶性高分子より成る勝の複屈折△nと膜厚dの積△n · d が0.1μmから3.0μmの範囲にあることが必要である。特にTFT用の場合はねじれ角は通常70度から150度、好ましくは80度から120度、△n · d は通常0.2から3.0μm、0.3から2.8μmの範囲が好ましく、STN用の場合はねじれ角が通常150度から300度、好ましくは170度から280度、△n · d が通常0.1から1.5μm好ましくは0.3から1.2μmの範囲が好ましい。ねじれ角および△n · d の値がこの範囲ないときは、目的とする色補償効果が不十分で、満足できる白黒表示が得られない。補償層を構成する分子が基板と垂直方向にらせん軸を有するらせん

構造をとり、かつ必要なねじれ角および△n · d をもつためには、上記した配向基板上に前述した層の光学活性化合物をベースの液晶性高分子にブレンドした組成物、または前述した比率の光学活性基を分子内に有する液晶性高分子を、上記した方法により配向、固定化し所定の膜厚とすればよい。

次に転写工程について説明する。まず、こうして得られた配向基板上の補償層と他の透光性基板とを、接着剤または粘着剤を用いて貼り付ける。次に配向基板と補償層の界面で補償層と等光性基板を剥離し、補償層を透光性基板側に転写して本発明の液晶表示素子用補償板が製造される。

用いられる透光性基板の例としては、透光性、光学的等方性を有するプラスチックフィルムが挙げられる。例えばポリメチルメタクリレート、ポリスチレン、ポリカーボネート、ポリエーテルスルファン、ポリフェニレンサルファイト、ポリアリレート、アモルファスポリオレフイン、トリアセチルセルロースあるいはエポキシ樹脂などを用いることができる。なかでもポリメチルメタクリレート、ポリカーボネート、ポリエーテルスルホン、ポリアリレート、アモルファスポリオレフインなどが好ましく用いられる。また用いられる透光性基板の別な種類として偏光フィルムを例示することができる。偏光フィルムは液晶ディスプレイに必須な光学要素であり、透光性基板として偏光フィルムを用いれば補償層と偏光フィルムが一体化された光学素子とすることができる極めて好都合である。また本発明で用いられる透光性基板の例として液晶表示セルそのものを挙げることができる。液晶セルは上下2枚の両極付きガラス基板を用いており、この上下いずれかあるいは両面のガラス上に補償層を転写すれば、表示セルの基板ガラスそのものが補償板となる。

透光性基板と補償層を貼りつける接着剤または粘着剤は光学グレードのものであれば特に制限はないが、アクリル系、エポキシ系、エチレン-酢酸共重合体系、ゴム系などを用いることができる。

補償層の透光性基板への転写は接着後配向基板を補償層との界面で剥離することにより行える。剥離の方法はロールなどを用いて機械的に剥離する方法、構成材料すべてに対する貪欲媒に浸漬したのち機械的に剥離する方法、貪欲媒中で超音波を当てて剥離する方法、配向基板と補償層との熱膨張係数の差を利用して温度変化を与えて剥離する方法、配向基板そのものまたは配向基板上の配向膜を溶解除去する方法などを例示することができる。剥離性は用いる高分子液晶と配向基板との密着性によつて異なるため、その系に最も適した方法を採用すべきである。

この様にして補償層、粘着剤(接着剤)層および透光性基板の3層構造より成る本発明の液晶表示素子用補償板が製造される。この補償板は、そのままで使用しても

良いし、表面保護のために透明プラスチックの保護層を設けてもよい。また偏光フィルムなどの他の光学素子と組み合わせた形で使用してもよい。

以上のように本発明の製造方法によつて製造された液晶表示素子用補償板は完全な白黒表示を可能にするばかりでなく、コストが安く薄くて軽い。さらに透光性基板の選択の幅がきわめて広く様々な性能および形態の補償板とすることができ、STN液晶ディスプレイ、TFT液晶ディスプレイなどに応用できる極めて工業的な価値の大きなものである。

#### (実施例)

以下に実施例を述べるが、本発明はこれらに制限されるものではない。なお実施例で用いた各分析法は以下の通りである。

##### (1) ポリマーの組成の決定

ポリマーを重水素化クロロホルムまたは重水素化トリフルオロ酢酸に溶解し、400MHzの<sup>1</sup>H-NMR（日本電子製）NH-QX400で測定し決定した。

##### (2) 対数粘度の測定

ウベローデ型粘度計を用い、エノール／テトラクロロエタン（60/40重量比）混合溶媒中、30°Cで測定した。

##### (3) 液晶相系列の決定

DSC（DuPont 990 Thermal Analyzer）測定および光学顕微鏡（オリンパス光学（株）製BH2偏光顕微鏡）観察により決定した。

##### (4) ねじれ角および△n·dの決定

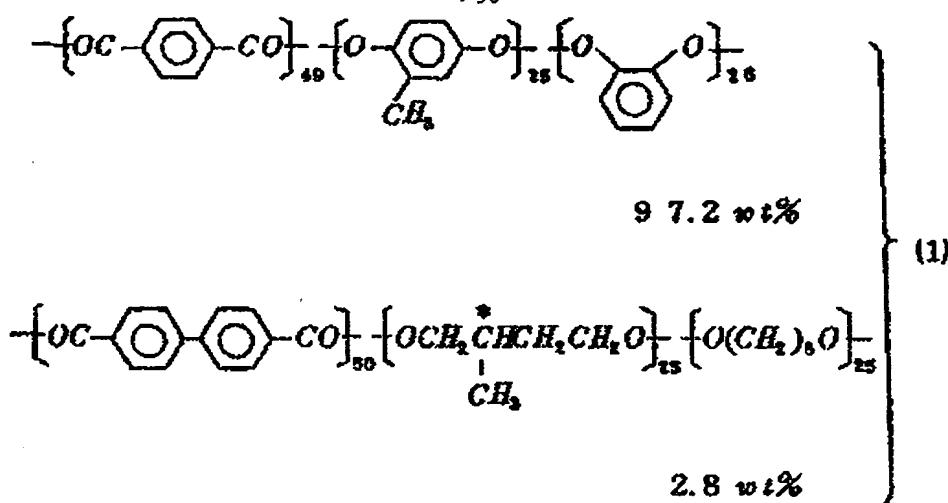
ねじれ角は偏光解析法により、また△n·dはエリブソメーターにより測定したデータを解析処理して決定した。

#### \* 実施例 1.

(1) 式で示した混合ポリマー（ベースポリマーの対数粘度0.18、Tg=95°C、光学活性ポリマーの対数粘度0.13）を含む15wt%のエノール／テトラクロロエタン（60/40重量比）溶液を調製した。この溶液を用いて、15cm×23cmの大きさで厚さが125μmのラビング処理したポリイミドフィルム上に、スクリーン印刷機を用いてキャストしたのち乾燥し、200°C×40分熱処理を行い、次に冷却して固定化した。この補償層のねじれ角は-231°。△n·dは0.84μmであった。この補償層の上にアクリル系接着剤を用いて15cm×23cmの大きさで厚さが10μmのポリエーテルスルファンフィルムを貼り付けた。次にポリイミドフィルムと補償層の界面をロールを用いて静かに引き剥がした。

こうして作製した補償板を、第2図に示す配置にしたがい1/200デューティー駆動のねじれ角が230°。△n·dは0.87μmのSTN液晶セルの上面に配置し、さらにその上に偏光板を貼付けて液晶セルを作製した。この際の上下偏光板の方向、上下電極基板のラビング方向、補償層の分子の配向方向は第3図に示すとおりである。上下偏光板の偏光軸のなす角度は90°、下偏光板と下電極基板のラビング方向のなす角度は45°。上電極基板ラビング方向と補償層の上電極基板と接する面の分子の配向方向とのなす角度は90°、補償層の上偏光板と接する面の分子の配向方向と上偏光板の透過軸のなす角度は45°である。

この液晶セルの表示色は完全な白黒であり、コントラスト比は60、輝度は100cd/m<sup>2</sup>で、高品位の表示が得られた。



\*印は光学活性炭素を示す。

#### 実施例 2.

(1) で示した混合ポリマー（ベースポリマーの対数粘度0.18、Tg=95°C、光学活性ポリマーの対数粘度0.13）を含む16wt%のエノール／テトラクロロエタン（60/40重量比）溶液を用いて、15cm×23cmの大きさで厚さが125μmのラビング処理したポリイミドフィルム上に、スクリーン印刷機を用いてキャストしたのち乾燥し、200°C×40分熱処理を行い、次に冷却して固定化した。この補償層のねじれ角は-231°。△n·dは0.84μmであった。この補償層の上にアクリル系接着剤を用いて15cm×23cmの大きさで厚さが10μmのポリエーテルスルファンフィルムを貼り付けた。次にポリイミドフィルムと補償層の界面をロールを用いて静かに引き剥がした。

こうして作製した補償板を、第2図に示す配置にしたがい1/200デューティー駆動のねじれ角が230°。△n·dは0.87μmのSTN液晶セルの上面に配置し、さらにその上に偏光板を貼付けて液晶セルを作製した。この際の上下偏光板の方向、上下電極基板のラビング方向、補償層の分子の配向方向は第3図に示すとおりである。上下偏光板の偏光軸のなす角度は90°、下偏光板と下電極基板のラビング方向のなす角度は45°。上電極基板ラビング方向と補償層の上電極基板と接する面の分子の配向方向とのなす角度は90°、補償層の上偏光板と接する面の分子の配向方向と上偏光板の透過軸のなす角度は45°である。

この液晶セルの表示色は完全な白黒であり、コントラスト比は60、輝度は100cd/m<sup>2</sup>で、高品位の表示が得られた。

41

0/40重合比) 溶液を調製した。この溶液を用いて、15cm×23cmの大きさで厚さが50μmのラビング処理したポリエーテルエーテルケトンフィルム上に、スクリーン印刷機を用いてキヤストしたのち乾燥し、200°C×45分熱処理を行い、次に冷却して固定化した。この補償層のねじれ角は-230°、△n·dは0.84μmであつた。この補償層の上に、15cm×23cmの大きさで厚さが120μmの粘着剤付き偏光フィルムを貼り付けた。このとき偏光フィルムの透過軸と配向基板のラビング方向とのなす角度は5度となるように貼り合わせた。次にこれをヘキサン中に浸漬し超音波を5分照射したのち引き上げ、配向基板と補償層を静かに引き剥がした。この偏光フィルム付き補償板の補償層が液晶セル側になるように第2の配置

(本実施例において第2図の22の補償板が補償層そのものである)でテストセルを組立て、その際の各光学軸は第3図の配置になるようにし実施例1と同様にして補償効果を調べた。この液晶セルの表示色は完全な白黒であり、コントラスト比は65、輝度は105cd/m<sup>2</sup>で、高品位の表示が得られた。

## 実施例 3.

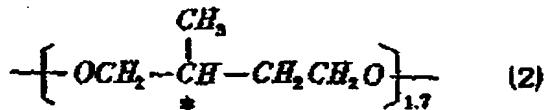
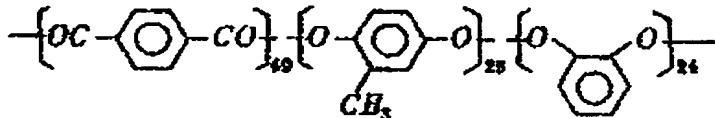
10

\*26

\* 式(2)の光学活性ポリマー(対数粘度0.15、Tq=81°C)の20wt%テトラクロロエタン溶液を調整した。別に15cm×23cmの大きさで厚さが2mmの表面研磨したステンレスチール板の上にポリビニルアルコール水溶液を塗布し乾燥したのちラビング処理して配向基板を作製した。この上にポリマー溶液をスピンドルコート法により塗布し乾燥したのち、180°Cで40分熱処理を行い、次に冷却固定化して補償層を形成した。この補償層のねじれ角は-228°、△n·dは0.835μmであつた。

この補償層の上に、15cm×23cmの大きさで厚さが120μmの粘着剤付きポリカーボネートフィルムを貼り付けた。これを水中に1時間浸漬したのち、水中で配向基板と補償層の界面を静かに引き剥がし乾燥した。この補償板の補償層が液晶セル側になるように第2図の配置でテストセルを組立て、その際の各光学軸は第3図の配置になるようにし、実施例1と同様にして補償効果を調べた。

この液晶セルの表示色は完全な白黒であり、コントラスト比は59、輝度は100cd/m<sup>2</sup>で、高品位の表示が得られた。



## 実施例 4.

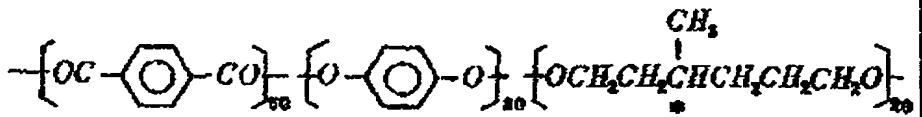
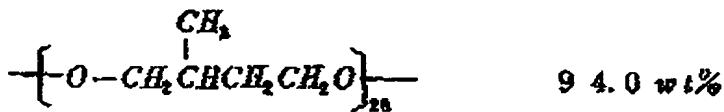
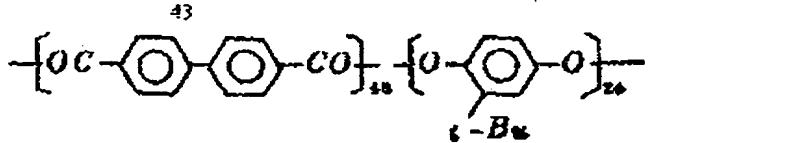
式(3)の混合ポリマー(ベースポリマーの対数粘度0.21、Tq=60°C、光学活性ポリマーの対数粘度0.18)の20wt%ジメチルフォルムアミド溶液を調整した。別に15cm×23cmの大きさで厚さが5mmの表面研磨したポリエーテルエーテルケトンシートを直接ラビング処理して配向基板を作製した。この上にポリマー溶液をスピンドルコート法により塗布し乾燥したのち、150°Cで20分熱処理を行い、次に冷却固定化して補償層を形成した。この補償層のねじれ角は-229°、△n·dは0.843μmであつた。

40

この補償層の上に、15cm×23cmの大きさで厚さが120μmの粘着剤付きトリアセチルセルロースフィルムを貼り付けた。1時間放置した後、配向基板と補償層の界面をロールを用いて静かに引き剥がした。この補償板の補償層が液晶セル側になるように第2図の配置でテストセルを組立て、その際の各光学軸は第3図の配置になるようにし、実施例1と同様にして補償効果を調べた。

この液晶セルの表示色は完全な白黒であり、コントラスト比は61、輝度は105cd/m<sup>2</sup>で、高品位の表示が得られた。

42



6.0 wt%

\*印は光学活性炭素を示す。

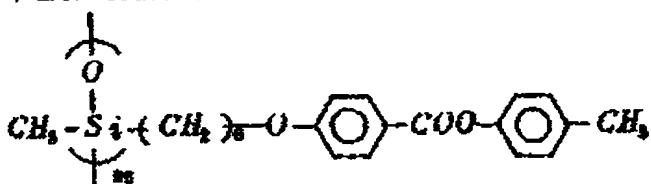
## 実施例 5.

式(4)の光学活性ポリマー(対数粘度0.23)の18wt%のトリクロロエタン溶液を調整した。別に15cm×23cmの大きさで厚さが80μmのポリエチレンテレフタレートフィルムを直接ラビング処理して配向基板を作製した。この上にポリマー溶液をカーテンコート法により塗布し乾燥したのち、100°Cで20分熱処理を行い、次に冷却固化して偏振層を形成した。この偏振層のねじれ角は-227°、△n·dは0.83μmであつた。

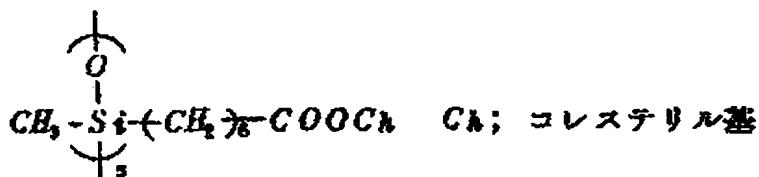
この偏振層の上に、15cm×23cmの大きさで厚さが120\*

\* μmの粘着付きポリエーテルスルファンフィルムを貼り付けた。これを-15°Cで1時間浸放したのち素早く配向基板と偏振層の界面を静かに引き剥がした。

この偏振板の偏振層が液晶セル側になるように第2図の配置でテストセルを組立て、その際の各光学軸は第3図の配置になるようにし、実施例1と同様にして偏振効果を調べた。この液晶セルの表示色は完全な白黒であり、コントラスト比は58、輝度は100cd/m<sup>2</sup>で、高品位の表示が得られた。



(4)



## 実施例 6.

(1)式で示した混合ポリマー(ベースポリマーの対数粘度0.18、光学活性ポリマーの対数粘度0.13)を含む15wt%のエタノール/テトラクロロエタン(60/40重量

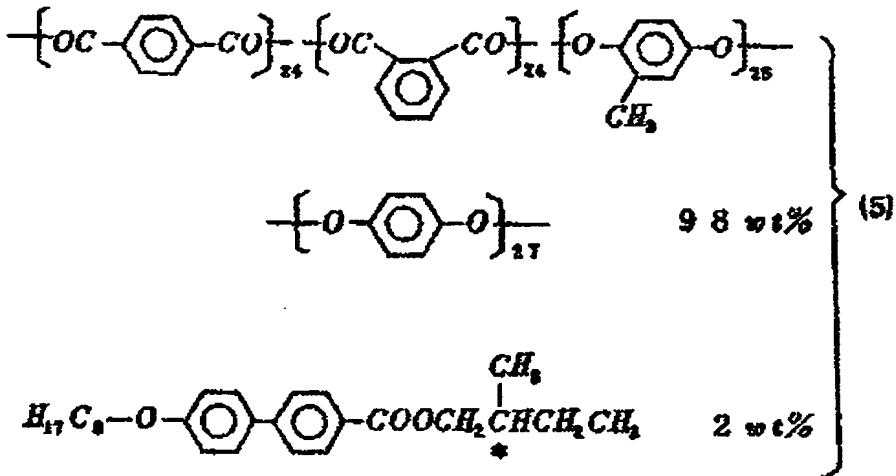
比)溶液を調製した。この溶液を用いて、15cm×23cmの大きさで厚さが50μmのラビング処理したポリエーテルエーテルケトンフィルム上に、スクリーン印刷機を用いてキャストしたのち乾燥し、200°C×40分熱処理を行

い。次に冷却して固定化した。この補償層のねじれ角は $-230^\circ$ 、 $\Delta n \cdot d$ は $0.84\mu m$ であつた。

次に実施例1で使用したSTN液晶セルの上面ガラス上に粘着剤を均一に塗布した。この粘着剤の上に作製した補償層付きポリエーテルエーテルケトンフィルムを補償層の面が粘着剤層と接するようにして貼合せた。1時間放置後ポリエーテルエーテルケトンフィルムのみを静かに引き剥し、補償層を液晶セル上面ガラス上に転写し、さらにその上に偏光フィルムを貼付けた。この際の各光学軸は第3図のように設定した。こうして作製した10 テストセルの表示は、完全に無彩色でありきれいな白黒表示が得られた。

#### 実施例 7.

(式5)で示した複合ポリマー(ベースポリマーの対数粘度0.18、 $T_g=72^\circ C$ )の15wt%エノールテトラクロロエタン溶液を調整した。配向基板として $10cm \times 10cm$ の大きさの直接ラピングしたポリイミドシートを用い、こ\*



#### ●印は光学活性炭素を示す。

##### (発明の効果)

本発明の液晶表示素子用補償板の製造法は配向基板と透光性基板と役割を分離したために、基板の選択の幅が大幅に広がり、様々な性能、形態の補償板を製造でき、TFT、STNタイプなどの各種液晶ディスプレイの高性能化、軽量化、薄型化および低コスト化にきわめて有用である。

##### 【図面の簡単な説明】

第1図は本発明の液晶表示素子用補償板の製造法を説明する図である。

第2図は本発明の実施例で使用した液晶セルの断面図である。

第3図は本発明の実施例で用いた液晶セルを構成する材料の各光学軸の相互の関係を示す。

11:配向基板

12:補償層(高分子液晶層)

13:粘着剤層

14:透光性基板

15:本発明の補償板

40 21:上偏光板

22:本発明の補償板

23:STN液晶セル

24:下偏光板

31:下偏光板透過軸

32:上偏光板透過軸

33:下偏光板ラピング方向

34:上偏光板ラピング方向

35:補償層の上偏光板と接している面の分子の配向方向

50 36:補償層の上偏光板と接している面の分子の配向方向

\*の溶液をスピンドルコート法により塗布した。塗布、乾燥後、 $150^\circ C$ で30分熱処理し、冷却固定化して補償層を形成した。補償層のねじれ角は $-90^\circ$ 、 $\Delta n \cdot d$ は $0.52\mu m$ であつた。

この補償層の上に粘着付き偏光フィルムを貼合わせた後、ポリイミドフィルムと補償層の界面を静かに剥離し補償層を偏光フィルム側に転写した。

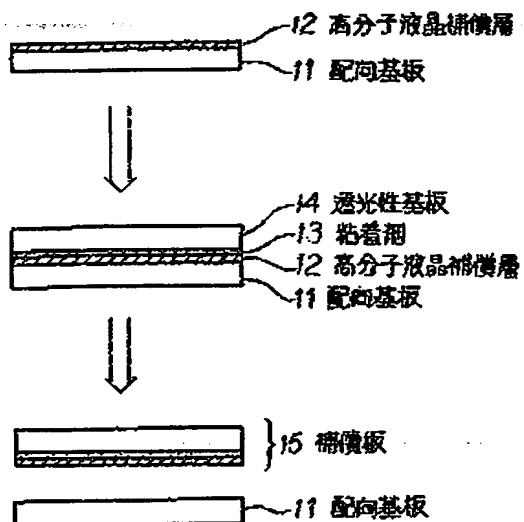
次にねじれ角 $90^\circ$ 、 $\Delta n \cdot d = 0.52\mu m$ のツイスティドネマチック(TN)液晶セルの上に、補償層がセル側になるようにしてこの補償板を配置した。この際各光学軸の設定は、液晶セル上偏光板のラピング方向と補償層の上偏光板に接する面の分子の配向方向とがなす角度が $90^\circ$ 、上下2枚の偏光フィルムのなす角度が $0^\circ$ となるようにした。

このテストセルの補償効果を調べた結果、補償板を用いないときに比べてはるかに完全な黒色が得られた。

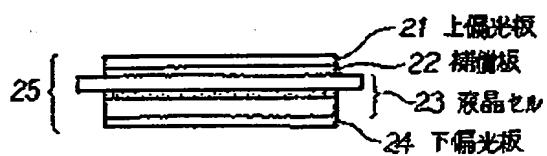
47  
 3a: 液晶セル分子のねじれ角  
 3b: 稼働層の分子のねじれ角  
 3c: 31と33のなす角度

\* 3d: 34と35のなす角度  
 3e: 31と32のなす角度  
 \* 3f: 32と36のなす角度

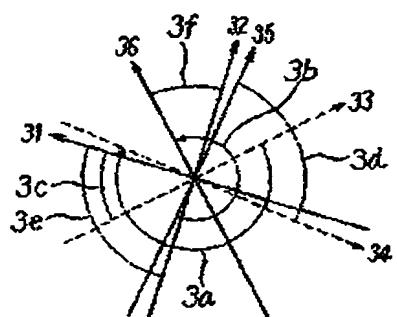
【第1図】



【第2図】



【第3図】



\* NOTICES \*

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2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

#### (Field of the Invention)

This invention relates to the manufacturing method of the useful compensating plate for liquid crystal display components, in order to cancel coloring of a liquid crystal display and to black-and-white-ize a display.

#### (Prior art)

The liquid crystal display occupies the big status in the display field on account of the descriptions, such as a low-battery drive, a light weight, and low cost. For example, a big screen display is possible for the super-twisted-nematic (it omits Following STN) liquid crystal display of a passive-matrix drive method in a multiplexer drive dot-matrix method, and since there are the descriptions, like contrast is high and an angle of visibility is large again compared with the conventional Twisted Nematic (TN) mold liquid crystal display, it is widely used in the field of the liquid crystal display which needs a big screen display, such as a personal computer, a word processor, and various data terminals. However, in order to display according to the birefringence effectiveness, yellow and blue coloring are avoided, and a STN method is inside \*\*\*\*. The display by this coloring mode is not only liked from the side to be used, but has the serious fault that it cannot respond to colorization.

Moreover, if it is going to make a cel gap thin also in the thin film galvanized iron JISUTA (it omits Following TFT) use liquid crystal display which is the example of representation of a active-matrix drive method for the purpose of improvement in a speed of response, improvement in a viewing-angle property, etc. in addition to the difficulty of the manufacture, the serious fault that similarly coloring arises will occur.

In order to change coloring mode into monochrome mode, the so-called two-layer cell method for which it therefore compensates arranging the liquid crystal cell for [ already much more ] compensation which made angle of torsion reverse about the cel gap same on the original STN liquid crystal cell for a display is put in practical use. Moreover, films for compensation (phase contrast film), such as a polycarbonate oriented film which adjusted only the birefringence property according to the cel for a display as a simpler approach, are developed, and the part is put in practical use.

However, although a two-layer cell method can realize monochrome display with quite high grace, it has a big fault [ cost is high, and it is heavy and ], such as being thick. Although an one side phase contrast film compensation method has the advantages [ it is cheap, is light and ], such as being thin, since it is an uniaxial stretched film without torsion structure, compensation of optical rotatory dispersion cannot be performed in compensation of only phase contrast, the important compensation engine performance is inadequate, and false monochrome display does not pass to be obtained, but contrast becomes and is [ / a two-layer method ] also low.

this invention persons proposed previously the compensating plate for liquid crystal display components which consists of the polymer liquid crystal film which fixed torsion nematic structure as that with which the fault of both this method is compensated (Japanese-Patent-Application-No. 1-150550 grade). The compensation engine performance equivalent to a two-layer cell method was made to give the film of one sheet formed on the translucency substrate with the orientation film, and the compensating plate of this invention is [ epoch-making ] \*\*\*\*\*. However, since this translucency substrate with the orientation film has the role to which orientation of the polymer liquid crystal is carried out at the time of manufacture, thermal resistance, solvent resistance, etc. are required other than orientation ability. Moreover, since this translucency substrate is used also as a configuration member of a compensating plate, transparency and the optical isotropy are required. Thus, in the conventional method, the demand to a translucency substrate is severe and the width of face of selection of a translucency substrate had restricted the engine performance of

a compensating plate, and a product result as narrowing and a result.

(Object of the Invention)

this invention persons noted being generated, in order that this trouble may carry out orientation of the liquid crystallinity macromolecule, may form a compensation layer on one translucency substrate with the orientation film and may use the stacking tendency substrate of a parenthesis as a configuration member of the compensating plate for liquid crystal display components as it is, as a result of examining wholeheartedly a means to solve this trouble that the compensating plate for liquid crystal displays of the invention concerned which used the liquid crystallinity macromolecule has. That is, when separating the substrate and the support substrate as a configuration member of the compensating plate for liquid crystal display components to which orientation of the liquid crystallinity macromolecule is carried out, the former could be used [ the thing without transparency and the optical isotropy, or ], and it found out that the latter could also use a thing without thermal resistance and solvent resistance, and this invention was completed at last.

(Means for solving invention)

That is, this invention relates to the manufacturing method of the compensating plate for liquid crystal display components characterized by imprinting the compensation layer which consists of the liquid crystallinity macromolecule formed on the orientation substrate on a translucency substrate.

As a desirable mode of this invention, a liquid crystallinity giant molecule can twist in the state of liquid crystal, nematic orientation is carried out, and the above-mentioned approach of being the liquid crystal giant molecule which will be in a vitreous state at the temperature below the liquid crystal transition point, the above-mentioned approach a translucency substrate is plastic film, the above-mentioned approach a translucency substrate is a polarization film, and the above-mentioned approach a translucency substrate is a glass substrate of the top face of a liquid crystal display cel or/and an inferior surface of tongue are mentioned.

This invention is explained to a detail below.

First, the outline of the manufacturing method of this invention is explained based on Fig. 1 . In this invention, a liquid crystallinity macromolecule is first applied on an orientation substrate (11). Next, it cools, after heat-treating at predetermined temperature and carrying out orientation of the liquid crystallinity macromolecule, and oriented structure is fixed, and a compensation layer (12) is made to form. Next, a translucency substrate (14) is stuck through adhesives or a binder (13) on this compensation layer. Next, a compensation layer is exfoliated in the interface of an orientation substrate and a compensation layer, and the compensating plate for liquid crystal display components of this invention (15) can be manufactured by imprinting a compensation layer to a translucency substrate side.

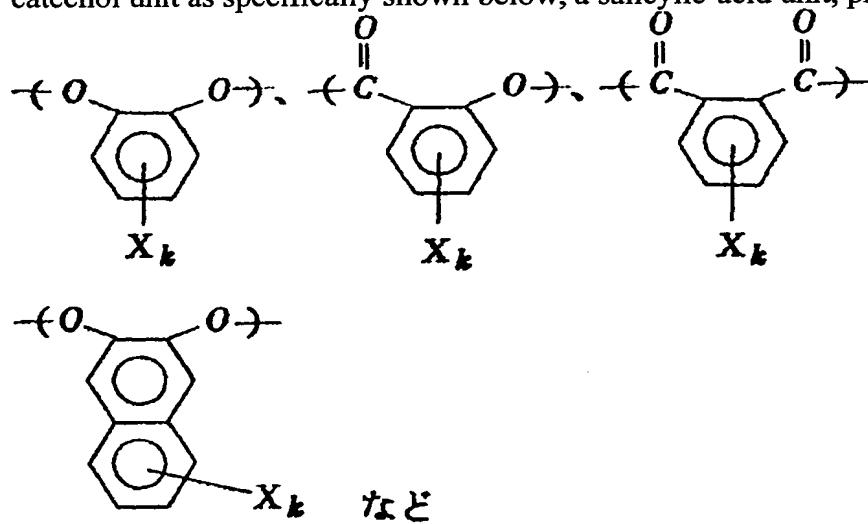
All can be used if it has the detachability which the orientation substrate of this invention says the substrate which has polymer liquid crystal orientation ability, and has the capacity to which orientation of the polymer liquid crystal is carried out as an orientation substrate used by this invention and predetermined thermal resistance, and solvent resistance, and can exfoliate a compensation layer. Orientation ability, the thermal resistance demanded, solvent resistance, or detachability Although there is no \*\*\*\*\* generally since it therefore differs in the class and property of the polymer liquid crystal to be used, as an example of representation of the orientation substrate used What has orientation film, such as well-known polyimide film which carried out rubbing, polyvinyl alcohol film which carried out rubbing, or slanting vacuum evaporationo film of oxidation silicon, is first mentioned on the shape of a sheet, such as metal plates, such as aluminum, iron, and copper, a plate made from pottery, an enamel plate, and glass, and a tabular substrate. As other examples, moreover, polyimide, polyamidoimide, polyether imide, A polyamide, a polyether ether ketone, a polyether ketone, poly ketone sulfide, Polyether sulfone, polysulfone, polyphenylene sulfide, Polyphenylene oxide, polyethylene terephthalate, polybutylene terephthalate, Polyacetal, a polycarbonate, acrylic resin, polyvinyl alcohol, The base which carried out direct rubbing processing of plastic film or sheet front faces, such as cellulose system plastics, an epoxy resin, and phenol resin, Or the substrate which has orientation film, such as polyimide film which carried out rubbing, and polyvinyl alcohol film which carried out rubbing, can be mentioned on these films or a sheet. Moreover, there are some which have the orientation ability of a liquid crystal polymer only by extending one shaft about the high thing of inner crystallinity of these plastic film or a sheet, and it does not carry out attaching direct rubbing processing or rubbing polyimide orientation ability about them, but \*\* also remains as it is and can be used as an orientation substrate. As an example, polyimide, polyether imide, a polyether ether ketone, polyether keto \*\* polyphenylene sulfide, polyethylene terephthalate, etc. can be mentioned.

Especially the orientation substrate that carried out direct rubbing of a film or sheets, such as the orientation base which has a rubbing polyimide layer or a rubbing polyvinyl alcohol layer on glass or a metal plate also

in these, polyimide, polyethylene terephthalate, polyphenylene sulfide, a polyether ether ketone, and polyvinyl alcohol, is desirable.

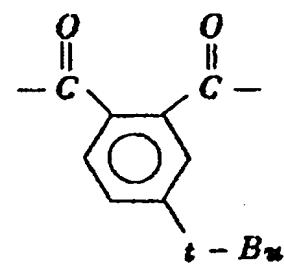
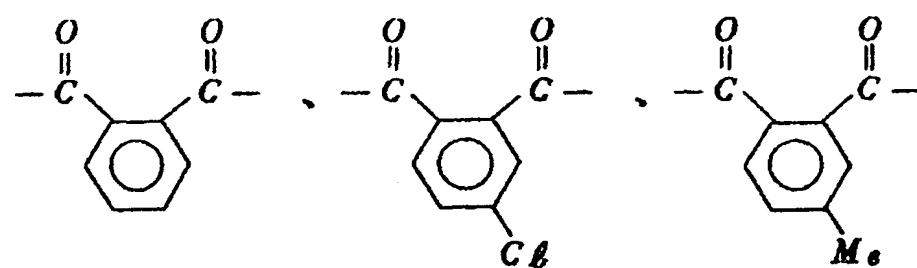
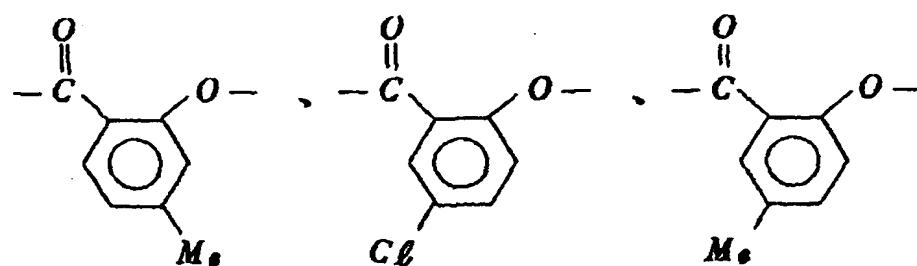
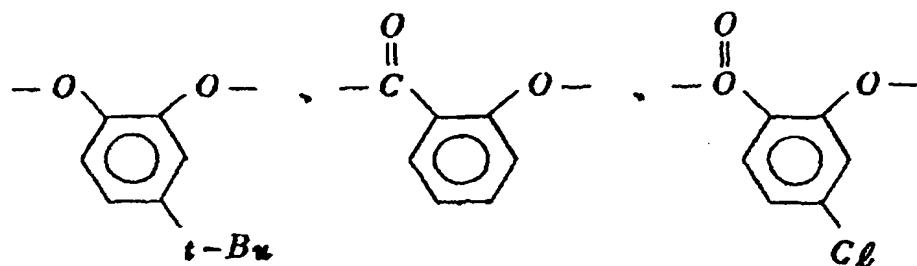
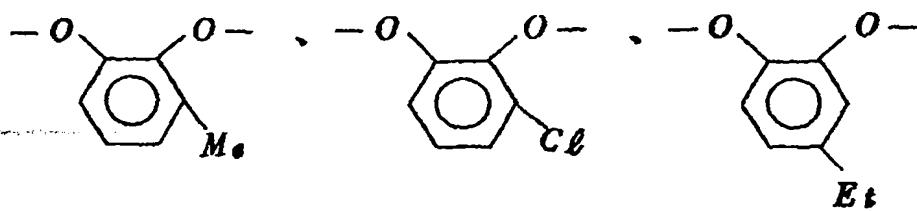
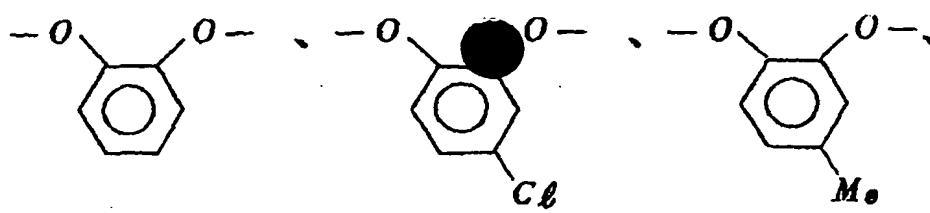
these orientation substrates top -- a liquid crystallinity giant molecule -- spreading and desiccation -- heat-treating -- uniform -- mono--- it cools, after making domain torsion nematic structure form, and a compensation layer is first formed on an orientation substrate by fixing without spoiling the orientation in a liquid crystal condition. the liquid crystallinity giant molecule used by this invention -- uniform -- mono--- the constituent which added the optically active compound of the specified quantity to the liquid crystallinity giant molecule which shows a domain nematic stacking tendency and can fix the orientation condition easily -- or -- uniform -- mono--- it is the liquid crystallinity giant molecule which shows a domain torsion nematic stacking tendency, and can fix the orientation condition easily.

it will become the base if the constituent which consists of a former nematic liquid crystallinity giant molecule and a former optically active compound first is explained -- uniform -- mono--- as for the liquid crystallinity giant molecule which shows a domain nematic stacking tendency and can fix the orientation condition easily, it is indispensable to have the following properties. In order to perform immobilization by which nematic orientation was stabilized, when it sees by the phase sequence of liquid crystal, it is important not to have a crystal phase in the low-temperature section from a nematic phase. when these phases exist and it cools for immobilization, these phases will be passed inevitably, and the nematic orientation obtained once as a result breaks -- having -- what has dissatisfied transparency and a dissatisfied compensation effect -- intermediary \*\*\*\*\*. Therefore, in order to produce the compensating plate of this invention, it is more indispensable than a nematic phase to use for the low-temperature section the liquid crystallinity macromolecule which has a glass phase. By adding an optically active compound to these polymers, it can twist in the state of liquid crystal, and nematic orientation is carried out, and in order to take a glass phase below in the liquid crystal transition point, torsion nematic structure is easily fixable. As a class of polymer used, all the things that will be in a vitreous state below in the liquid crystal transition point can be used by carrying out nematic orientation in the state of liquid crystal, for example, side-chain mold liquid crystal polymers, such as principal chain mold liquid crystal polymers, such as polyester, a polyamide, a polycarbonate, and polyester imide, or polyacrylate, polymethacrylate, poly malonate, and a polysiloxane, etc. can be illustrated. A composite ease, transparency, a stacking tendency, a glass transition point, etc. to polyester is desirable especially. although the polymer which includes an orthochromatic permutation aromatic series unit as a constituent as polyester used is the most desirable -- instead of [ of an orthochromatic permutation aromatic series unit ] -- bulk -- the polymer which contains as a constituent the aromatic series which has the aromatic series which has a high substituent, a fluorine, or a fluorine-containing substituent can also be used. The orthochromatic permutation aromatic series unit said by this invention means the structural unit which presupposes mutually that it is association which makes a principal chain at least as orthochromatic. What has a substituent can be raised to the benzene ring of a catechol unit as specifically shown below, a salicylic-acid unit, phthalic-acid units, and these radicals.



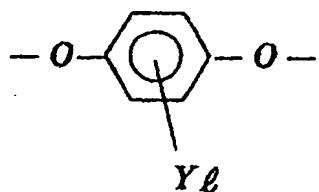
(Moreover, as for X, halogens, such as hydrogen, and Cl, Br, and a carbon number show the alkyl group, alkoxy group, or phenyl group of 1 to 4, k is 0-2.)

The following can be especially illustrated as a desirable example also in these.

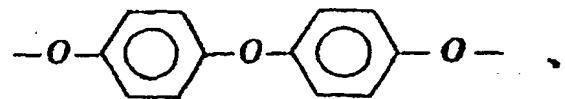
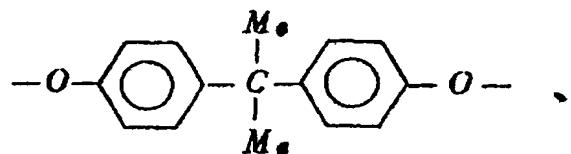
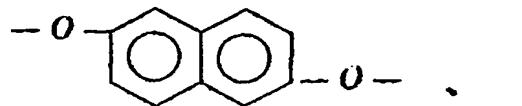
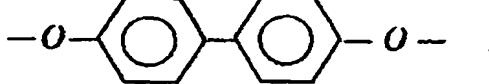


the structural unit (henceforth a dicarboxylic-acid component) guided from the structural unit (henceforth a diol component) and the dicarboxylic acid guided from (a) diols as polyester preferably used by this invention, and/or (b) -- the polymer which includes said orthochromatic permutation aromatic-series unit preferably including the structural unit (henceforth a hydroxy-acid component) guided from the hydroxy acid which contains a carboxylic acid and a hydroxyl group in coincidence as a constituent in one unit can illustrate.

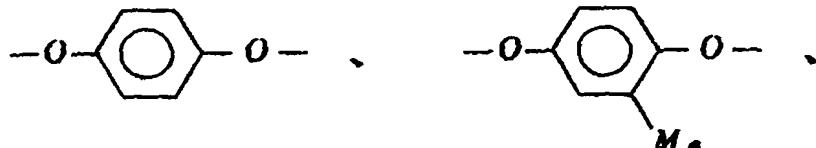
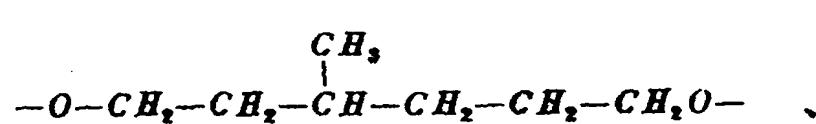
As a diol component, the diol of the following aromatic series and aliphatic series can be mentioned among these.



(As for the alkyl group or alkoxy \*\*\*\* of the halogen carbon numbers 1-4, such as hydrogen, and Cl, Br, Y shows a phenyl group.) 1 is 0-2. \*\*

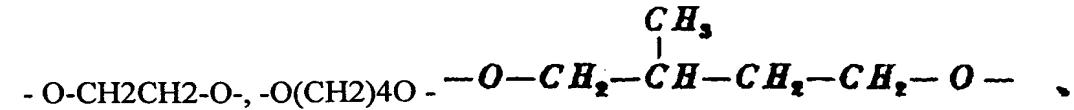
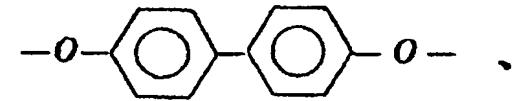
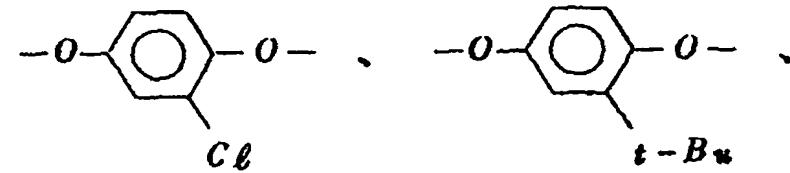


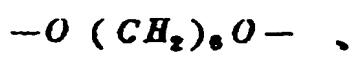
$-O(\text{CH}_2)_nO$  - (n expresses the integer of 2 to 12)



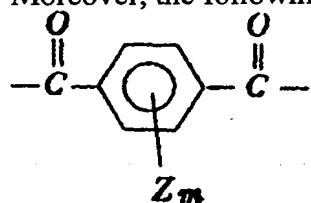
**M•**

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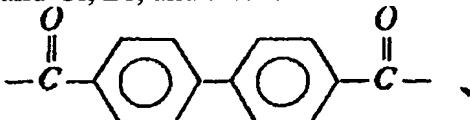




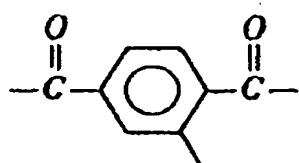
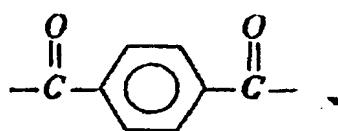
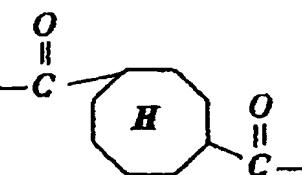
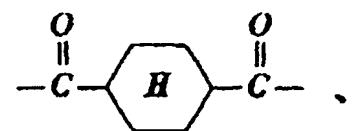
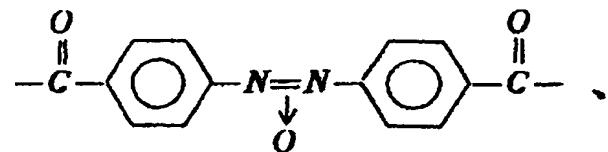
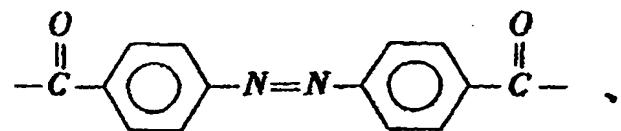
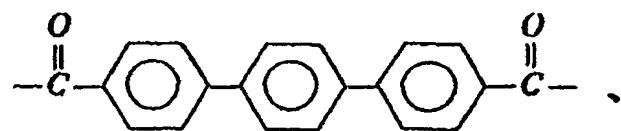
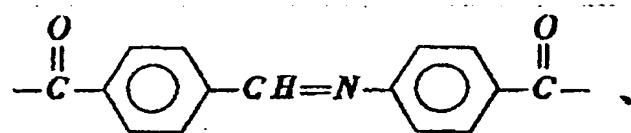
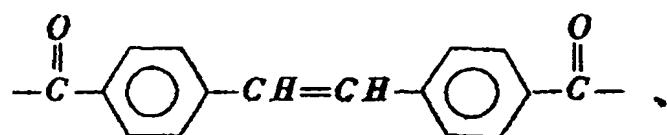
\*\*\*\* is used preferably (Me shows a methyl group among a formula and Bu shows butyl). Moreover, the following can be illustrated as a dicarboxylic acid component.



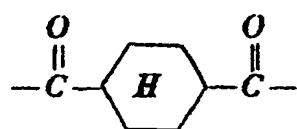
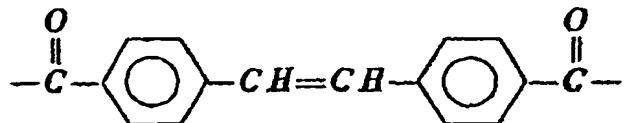
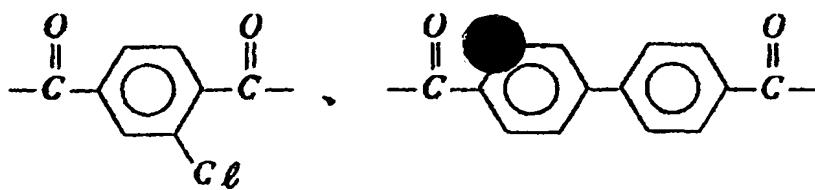
(As for Z, halogens, such as hydrogen, and Cl, Br, and a carbon number show the alkyl group, alkoxy group,



or phenyl group of 1 to 4.) m is 0-2. \*\*

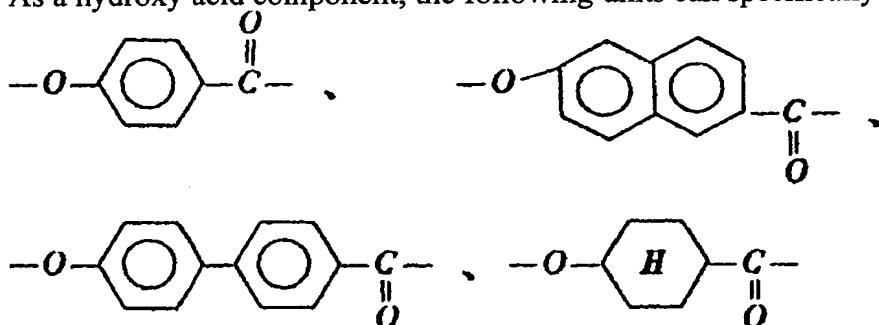


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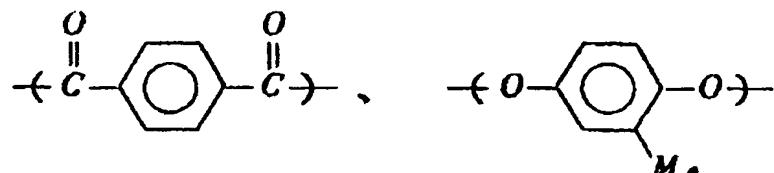
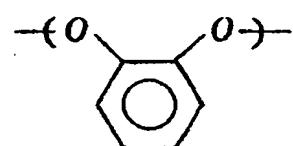
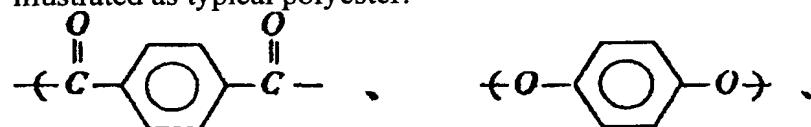


\*\*\*\* is desirable.

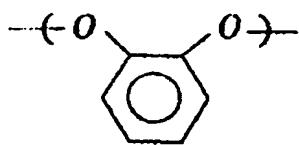
As a hydroxy acid component, the following units can specifically be illustrated.

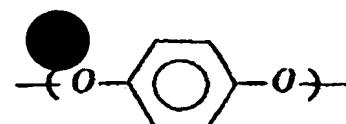
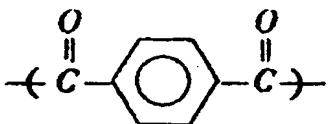


Moreover the mole ratio of dicarboxylic acid and diol is a profile 1:1 like common polyester (the Galle Bonn acid radical and a hydroxyl group when hydroxy acid is used comparatively), the range of five-mol % to 40-mol % is desirable still more desirable, and the range of the rate of the orthochromatic permutation aromatic series unit occupied in polyester is ten-mol % to 30-mol %. When fewer than five-mol %, a crystal phase appears [ tend ] and is not desirable under a nematic phase. Moreover, a polymer stops tending not to show liquid crystallinity and is not desirable when [ than 40 mol % ] more. The following polymers can be illustrated as typical polyester.

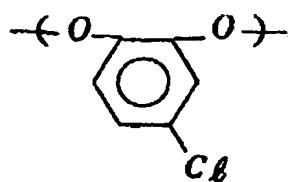


The polymer which consists of \*\*\*\*\*,

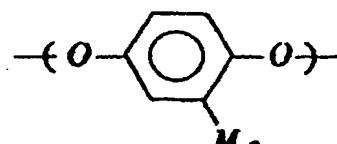
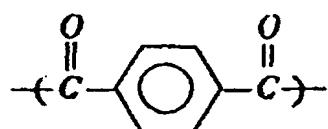
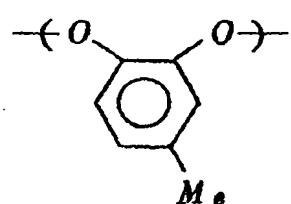
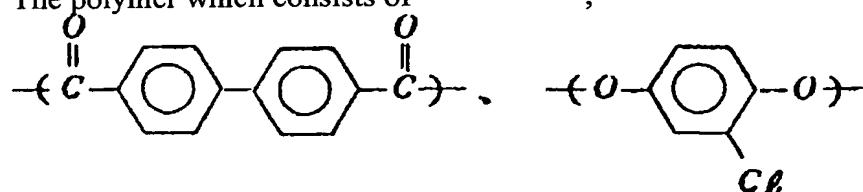




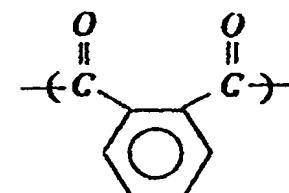
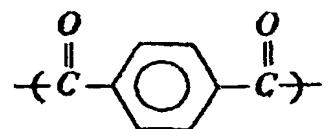
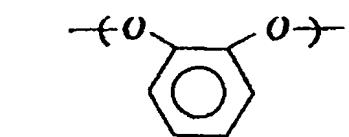
The polymer which consists of \*\*\*\*\*,



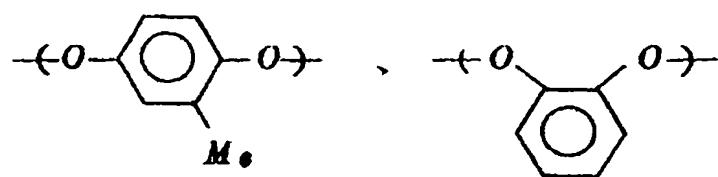
The polymer which consists of \*\*\*\*\*,

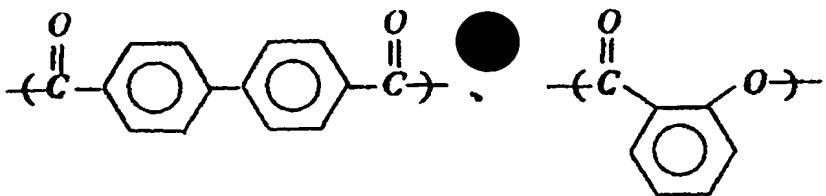


The polymer which consists of \*\*\*\*\*,



The polymer which consists of \*\*\*\*\*,

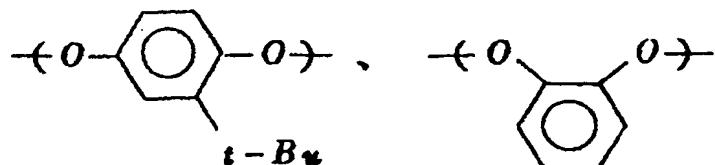




The polymer which consists of \*\*\*\*\*,

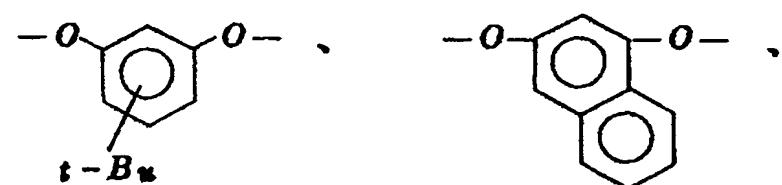
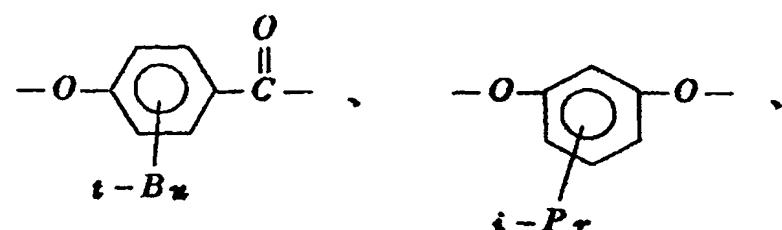
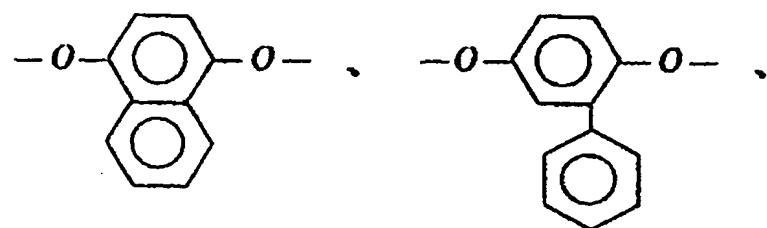
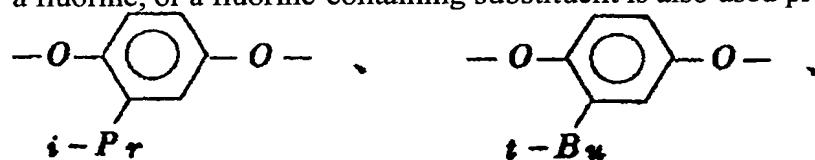


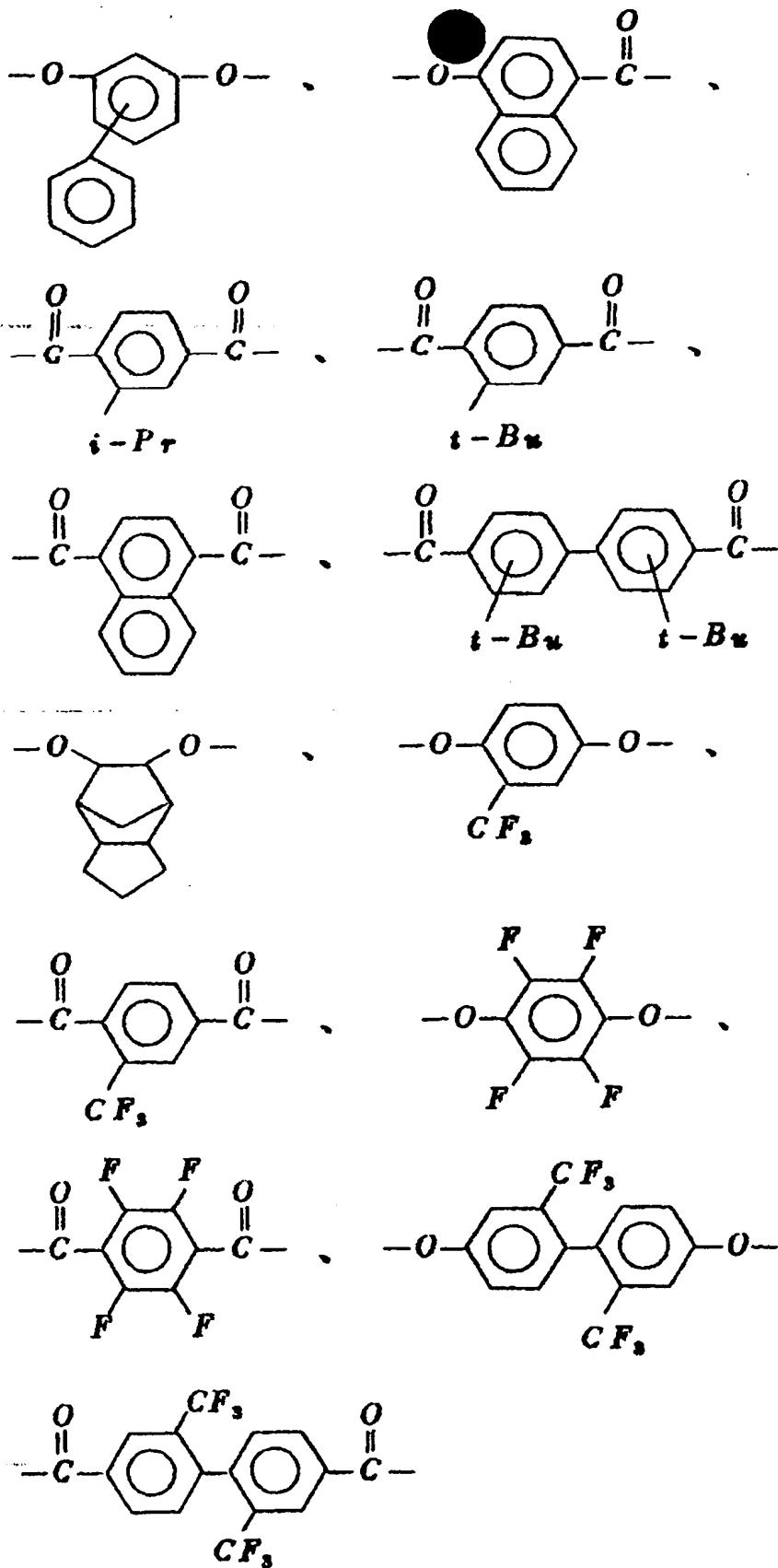
The polymer which consists of \*\*\*\*\*,



The polymer which consists of \*\*\*\*\*.

bulk as changed per orthochromatic permutation aromatic series and shown below -- the polymer which makes a constituent the aromatic series unit containing the aromatic series unit containing a high substituent, a fluorine, or a fluorine-containing substituent is also used preferably.



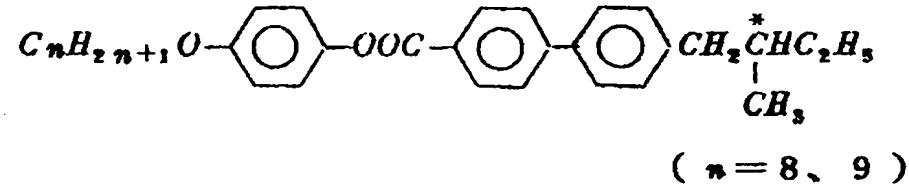
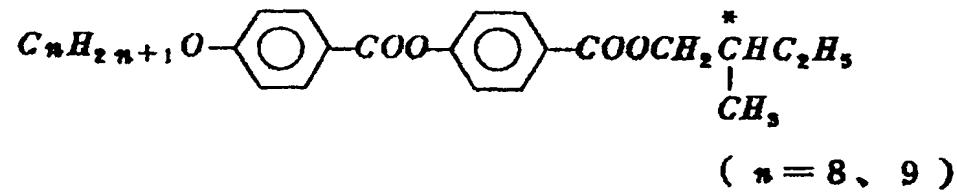
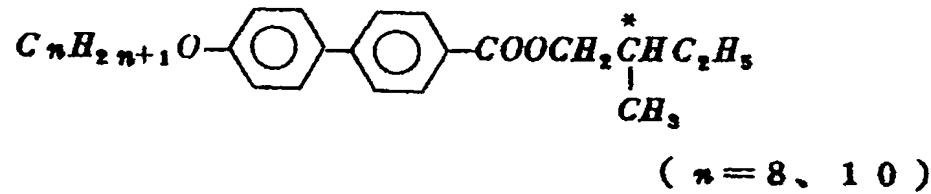
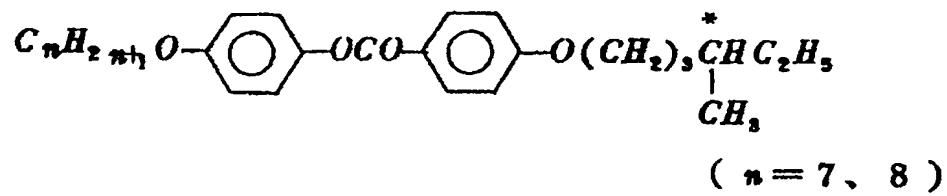
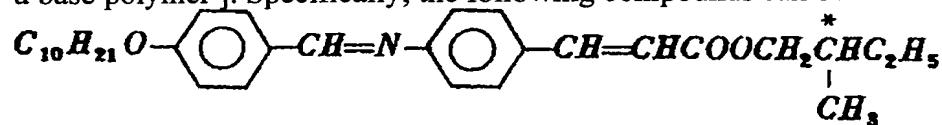


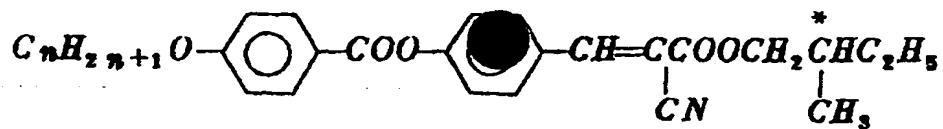
the logarithm which measured the molecular weight of these polymers at 30 degrees C among [ various ] the solvent, for example, a phenol / tetrachloroethane (60/40-fold quantitative ratio) mixed solvent, -- for viscosity, the range of 0.05 to 3.0\*\* is 0.07 to 2.0 desirable still more preferably. a logarithm -- when viscosity is smaller than 0.05, the reinforcement of the obtained polymer liquid crystal becomes weak and is not desirable. Moreover, when larger than 3.0, troubles, such as an increment in the time amount which the viscosity at the time of liquid crystal formation is too high, and a fall and orientation of a stacking tendency

take, arise. Moreover, the gas transition point of these polyester is also important and the stability of the orientation after carrying out orientation immobilization is affected. Although based also on an application, if it thinks that it is generally used near a room temperature, it is desirable for a glass transition point to be 30 degrees C or more, and it is desirable that it is especially 50 degrees C or more. When a glass transition point is lower than 30 degrees C, if it is used near a room temperature, the function which the liquid crystal structure fixed once may change and originates in liquid crystal structure falls and is not desirable.

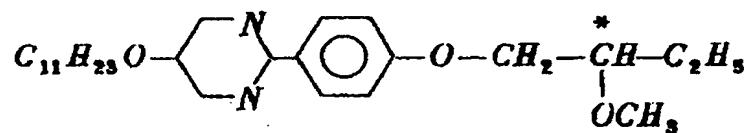
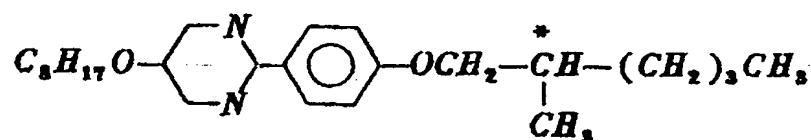
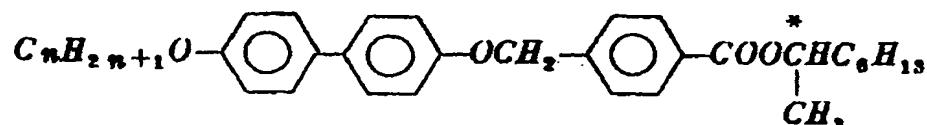
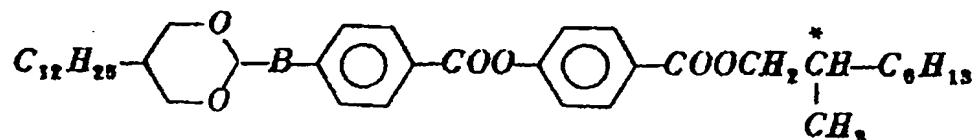
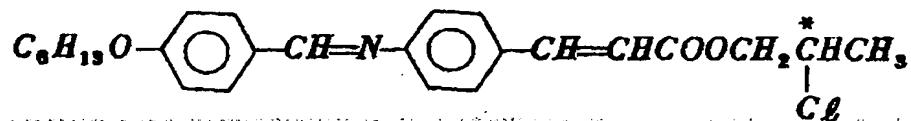
Especially the synthesis method of these polymers is not restricted and is compounded in the field concerned by the well-known polymerization method, for example, a melting polymerization method, or the acid chloride method using the acid chloride of corresponding dicarboxylic acid. Under an elevated temperature and a high vacuum, therefore the dicarboxylic acid which is compounded by the melting polymerization method and which case [ dicarboxylic acid ] for example, corresponds, and the corresponding acetylation object of diol can be manufactured to carry out a polymerization, and, therefore, molecular weight can carry them out to control of polymerization time amount, or control of a brewing presentation easily. In order to promote a polymerization reaction, metal salts, such as well-known sodium acetate, can also be used from the former. Moreover, when using a solution polymerization method, the dicarboxylic acid dichloride and diol of the specified quantity can be dissolved in a solvent, and target polyester can be easily obtained by heating under existence of acid acceptors, such as a pyridine.

If the optically active compound mixed in order to give torsion to these nematic liquid crystallinity polymer is explained, a low molecular weight compound [ optical activity / as a typical example / first ] can be raised. Although all can be used for this invention if it is the compound which has optical activity, it is desirable that it is a liquid crystallinity compound [ optical activity / from a viewpoint of compatibility with a base polymer ]. Specifically, the following compounds can be illustrated.



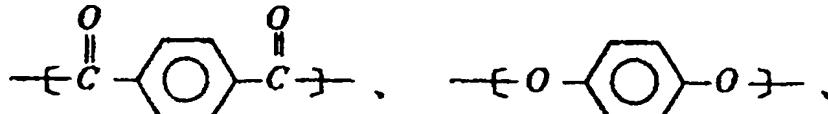
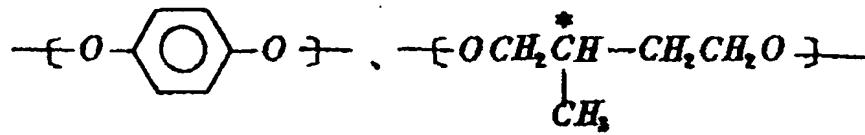
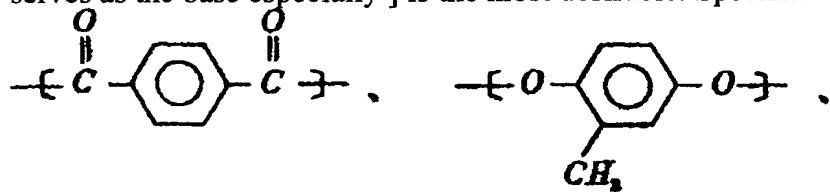


( n = 7, 8 )

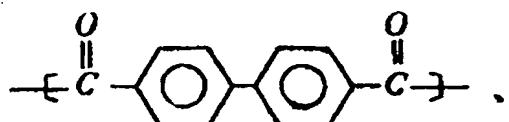
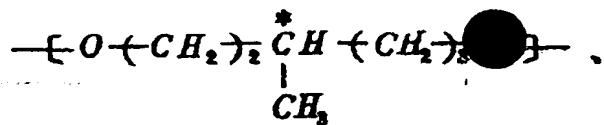


Cholesterol derivative etc.

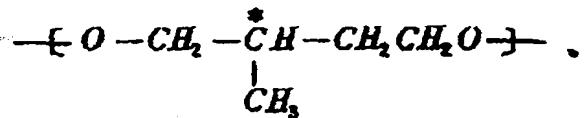
As an optically active compound used by this invention, a high molecular compound [ optical activity next ] can be raised. Although all can be used if it is the giant molecule which has a radical [ optical activity / intramolecular ], it is desirable that it is the giant molecule in which liquid crystallinity is shown from a viewpoint of compatibility with a base polymer. The polyacrylate of liquid crystallinity which has a radical [ optical activity / as an example ], polymethacrylate, poly malonate, a polysiloxane, polyester, a polyamide, polyester amide, a polycarbonate or a polypeptide, a cellulose, etc. can be raised. Polyester [ optical activity / subject / aromatic series / from compatibility with the nematic liquid crystallinity polymer which serves as the base especially ] is the most desirable. Specifically, the following polymers can be illustrated.



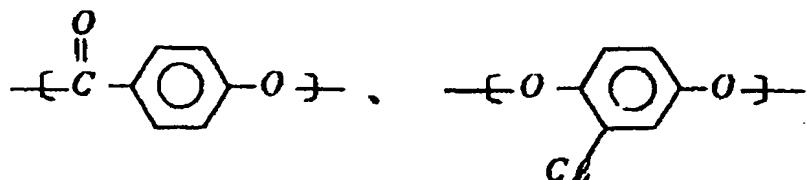
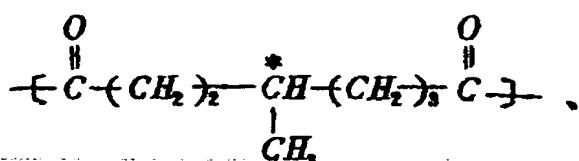
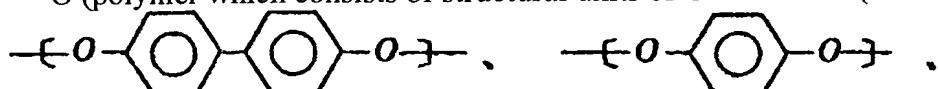
The polymer which consists of \*\*\*\*\*,



The polymer which consists of \*\*\*\*\*,



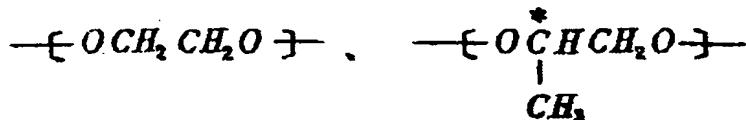
\*\* O (polymer which consists of structural units of  $CH_2^{**n}O^{**}$  ( $n=2-12$ ))



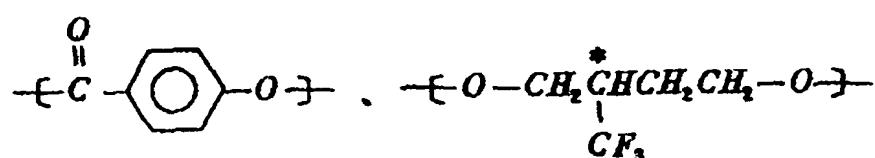
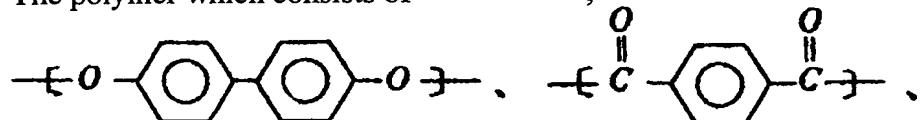
The polymer which consists of \*\*\*\*\*,



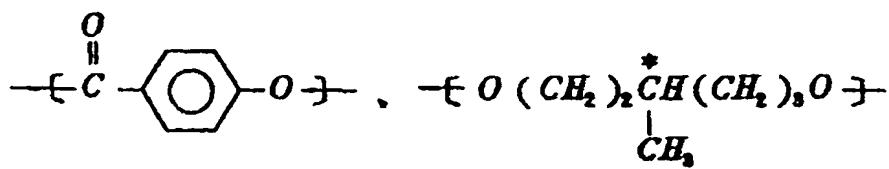
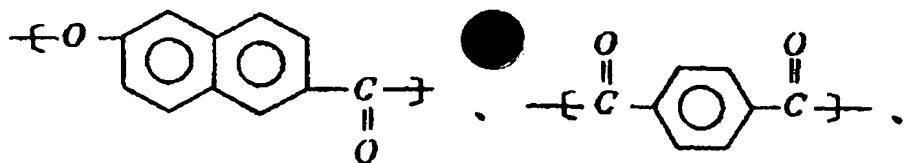
The polymer which consists of \*\*\*\*\*,



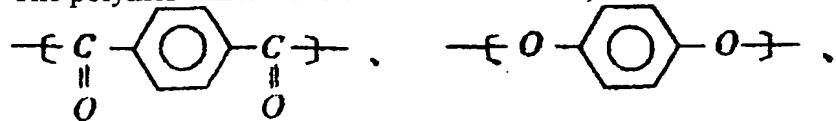
The polymer which consists of \*\*\*\*\*,



The polymer which consists of \*\*\*\*\*,

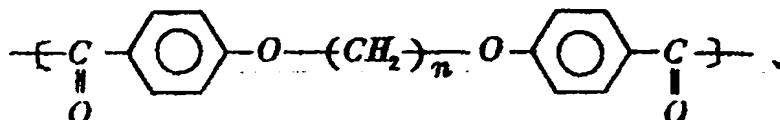


The polymer which consists of \*\*\*\*\*,

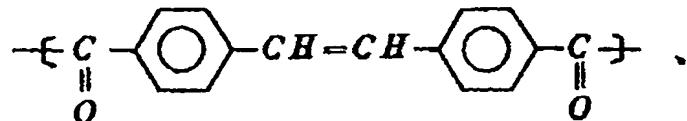
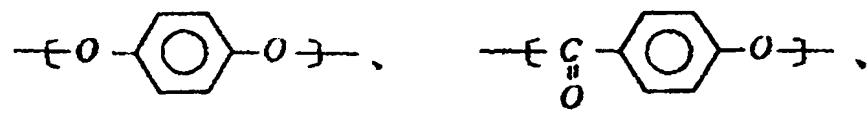


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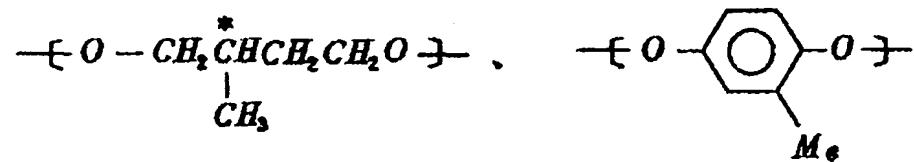
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The polymer which consists of \*\*\*\*\*,



The polymer which consists of \*\*\*\*\*,



The polymer which consists of \*\*\*\*\*.

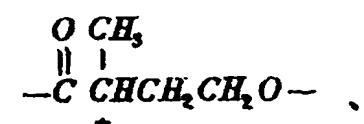
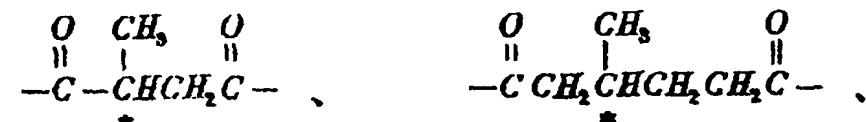
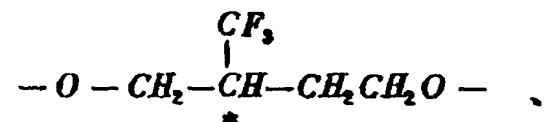
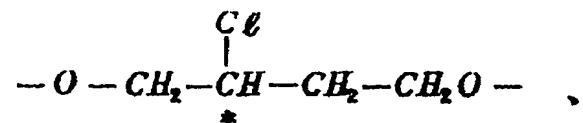
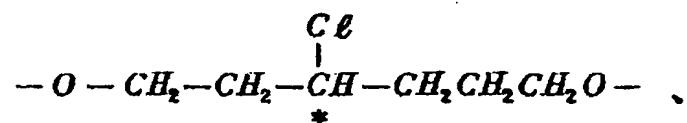
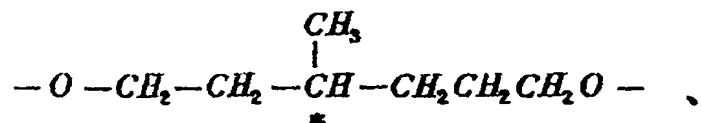
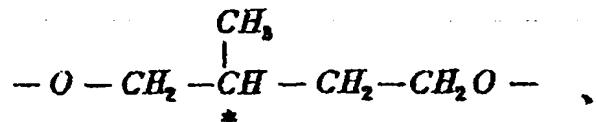
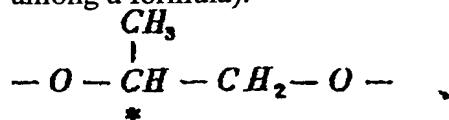
The percentage of the optical activity radical occupied in these polymers is usually 0.5-mol % - 80-mol %, and is preferably [ five mol % - 60 mol% of ] desirable.

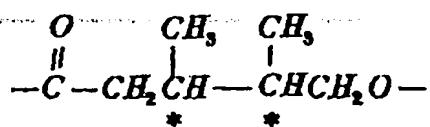
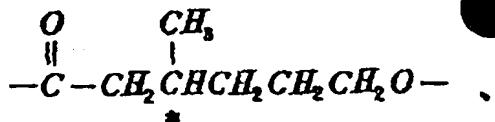
moreover, the logarithm which measured the molecular weight of these polymers at 30 degrees C for example, among a phenol/tetrachloroethane -- the range of 0.05 to 5.0 has desirable viscosity. a logarithm -- since viscosity is too high and causes the fall of a stacking tendency as a result when viscosity is larger than 5.0, it becomes [ control of a presentation ] difficult and is not desirable when [ which is not desirable ] smaller than 0.05.

Preparation of these constituents is a predetermined rate and, therefore, can carry out nematic liquid crystallinity polyester and an optically active compound to approaches, such as solids mixing, solution mixing, or melt mixing. Although the rates of the optically active compound occupied in a constituent therefore differ in the torsion force when giving torsion to the ratio of a radical [ optical activity / in an optically active compound ], or the nematic liquid crystal of the optically active compound, generally its

range of 0.1 to 50wt(s)% is desirable, and its range of 0.5 to 30wt(s)% is especially desirable. 0. When fewer than 1wt%, sufficient torsion for a nematic liquid crystal cannot be given, and when [ than 50wt(s)% ] more, it is \*\*\*\*\* about a bad influence to a stacking tendency.

without the compensating plate of this invention uses other optically active compounds again -- self -- uniform -- mono--- therefore, it can \*\*\*\*\* to use the polymer liquid crystal which carries out domain torsion nematic orientation, and can fix the orientation condition easily. In a principal chain, these polymers have an optical-activity radical, and it is indispensable that self is optical activity and they can specifically illustrate side-chain mold liquid crystal polymers, such as principal chain mold liquid crystal polymers, such as optical activity polyester, a polyamide, a polycarbonate, and polyester imide, or polyacrylate, polymethacrylate, and a polysiloxane, etc. A composite ease, a stacking tendency, a glass transition point, etc. to polyester is desirable especially. although the polymer which includes an orthochromatic permutation aromatic series unit as a constituent as polyester used is the most desirable -- instead of [ of an orthochromatic permutation aromatic series unit ] -- bulk -- the polymer which contains as a constituent the aromatic series which has the aromatic series which has a high substituent, a fluorine, or a fluorine-containing substituent can also be used. These optical activity polyester is obtained by introducing an optical-activity radical as shown in the nematic liquid crystallinity polyester explained until now below using still optical activity diol, dicarboxylic acid, and hydroxy acid (\* mark shows optical-activity carbon among a formula).



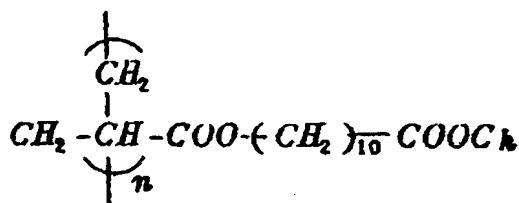
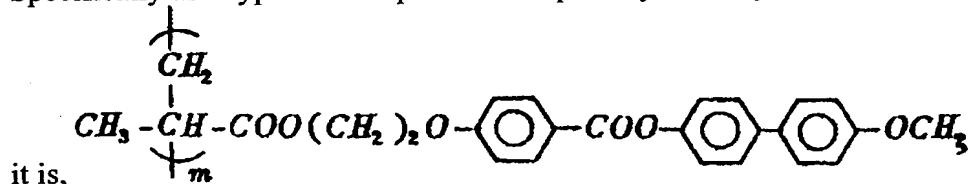


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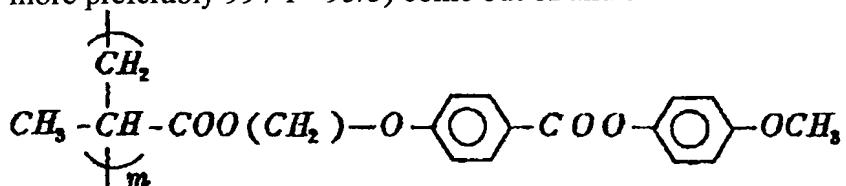
The rate of occupying in the polymer of these optical activity radicals has the desirable 0.1 to 20-mol range of %, and its the 0.5 to ten-mol range of % is especially desirable. When there are few rates of an optical activity radical than 0.1%, torsion structure required for a compensating plate is not acquired, and when [ than 20 mol % ] more, the torsion force is too strong, and it causes the fall of a compensation effect and is not desirable. the logarithm which measured the molecular weight of these polymers at 30 degrees C among [ various ] the solvent, for example, a phenol / tetrachloroethane (60/40) mixed solvent, -- viscosity is desirable still more desirable and the range of 0.05 to 3.0 is 0.07 to 2.0. a logarithm -- when viscosity is smaller than 0.05, the reinforcement of the obtained polymer liquid crystal becomes weak and is not desirable. Moreover, when larger than 3.0, problems, such as an increment in the time amount which the viscosity at the time of liquid crystal formation is too high, and a fall and orientation of a stacking tendency take, arise. Moreover, the glass transition point of these polyester is also important, and the stability of the orientation after carrying out orientation immobilization is affected. Although based also on an application, if it thinks that it is generally used near a room temperature, it is desirable for a glass transition point to be 30 degrees C or more, and it is desirable that it is especially 50 degrees C or more. When a glass transition point is lower than 30 degrees C, if it is used near a room temperature, the function which the liquid crystal structure fixed once may change and originates in liquid crystal structure falls and is not desirable.

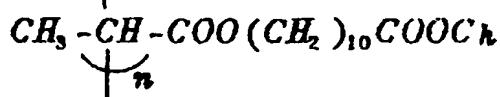
the melt polycondensation method which mentioned the polymerization of these polymers above, or an acid clo -- the id -- therefore, it can carry out to using a method.

Specifically as a typical example of the liquid crystallinity macromolecule of this invention described above,

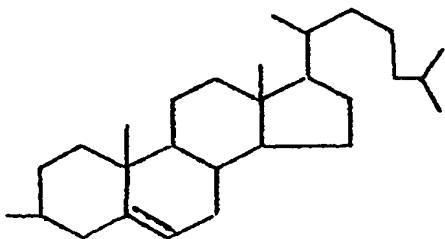


Ch; cholesteryl radical and the polymer (m/n = usually 99.9 / 0.1 - 80/20, preferably 99.5 / 0.5 - 90/10, still more preferably 99 / 1 - 95/5) come out of and shown



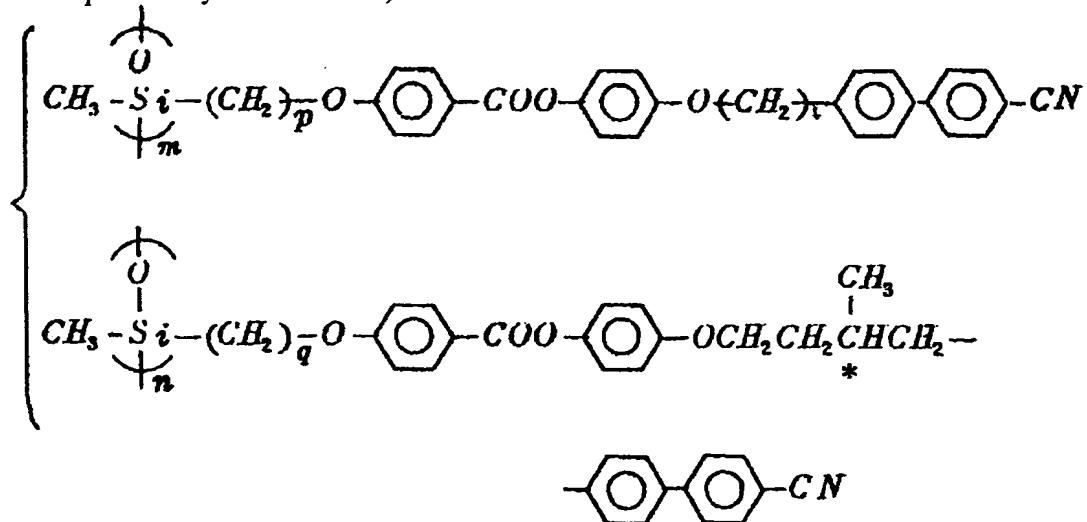


*Ch:*

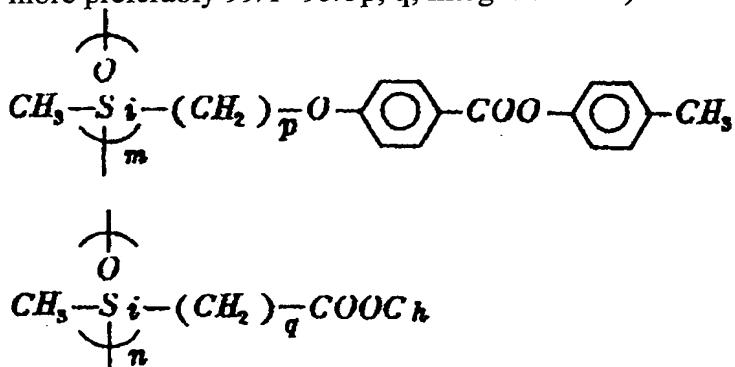


### コレステリル基

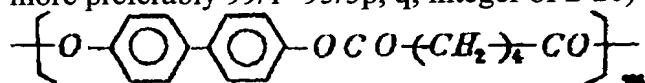
The polymer come out of and shown ( $m/n =$  usually 99.9 / 0.1 - 80/20, preferably 99.5 / 0.5 - 90/10, still more preferably 99 / 1 - 95/5)

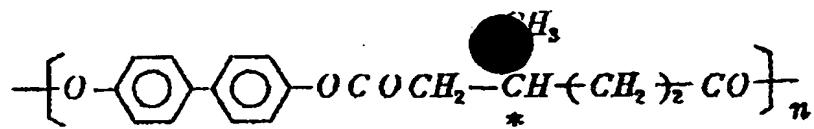


The polymer come out of and shown ( $m/n =$  usually 99.9 / 0.1 - 70/30, preferably 99.5 / 0.5 - 90/10, still more preferably 99/1- 95/5p, q; integer of 2-20)

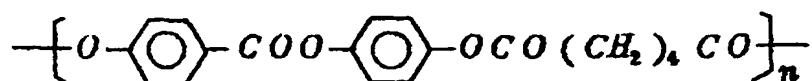
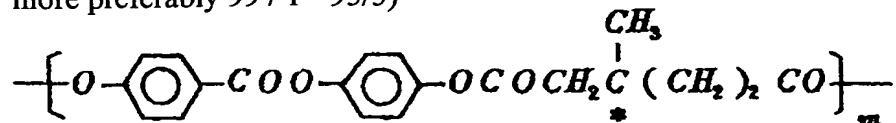


The polymer come out of and shown ( $m/n =$  usually 99.9 / 0.1 - 70/30, preferably 99.5 / 0.5 - 90/10, still more preferably 99/1- 95/5p, q; integer of 2-20)

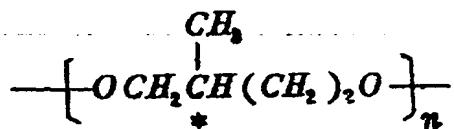
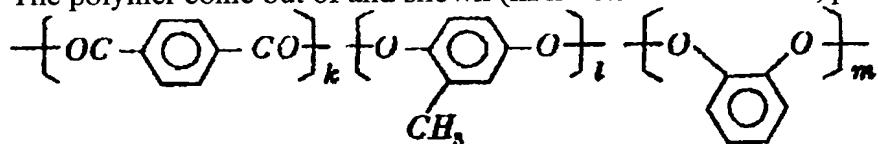




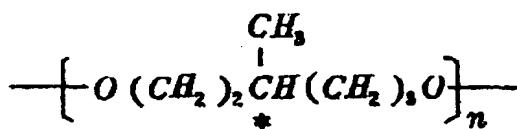
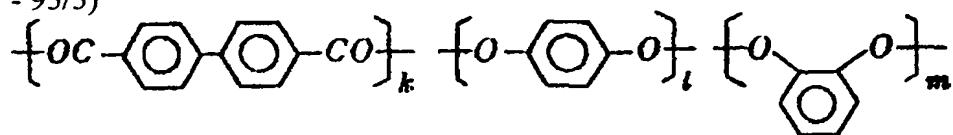
The polymer come out of and shown ( $m/n =$  usually  $99.9 / 0.1 - 80/20$ , preferably  $99.5 / 0.5 - 90/10$ , still more preferably  $99 / 1 - 95/5$ )



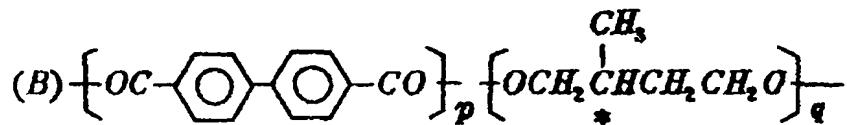
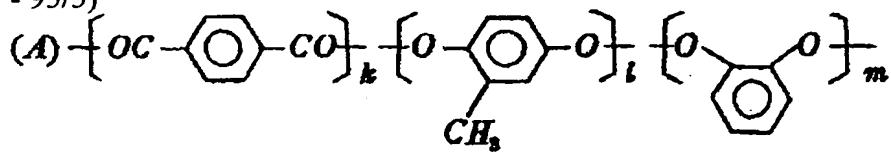
The polymer come out of and shown ( $m/n = 0.5 / 99.5 - 10/90$ , preferably  $1 / 99 - 5/95$ )



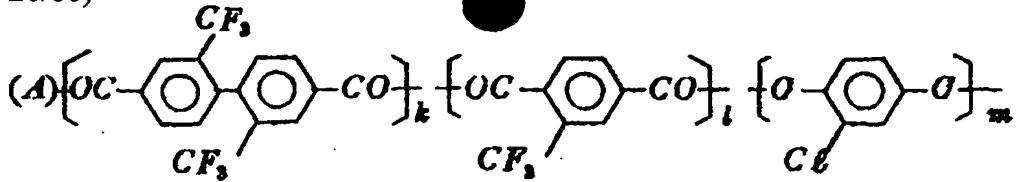
The polymer come out of and shown ( $k/n = k=l+m+n$ ,  $99.5 / 0.5 - 90/10$ , preferably  $99 / 1 - 95/5$ ,  $l/m = 5 / 95 - 95/5$ )



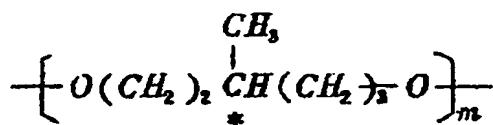
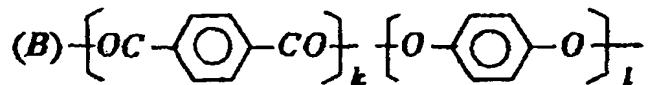
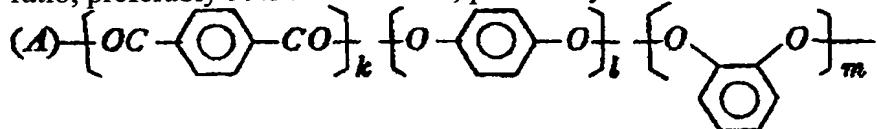
The polymer come out of and shown ( $k/n = k=l+m+n$ ,  $99.5 / 0.5 - 90/10$ , preferably  $99 / 1 - 95/5$ ,  $l/m = 5 / 95 - 95/5$ )



Polymer mixture come out of and shown ((A)/(B) = usually  $99.9 / 0.1 - 80/20$  (weight ratio), preferably  $99.5 / 0.5 - 85/5$ , still more preferably  $99 / 1 - 95/5$ ,  $k=l+m$ ,  $l/m = 75 / 25 - 25/75$ ,  $p=q+r$ ,  $p/q = 80 / 20 - 99.5 / 0.5 - 85/5$ )



(B) Polymer mixture shown by cholesteryl benzoate ((A)/(B) = usually 99.9 / 0.1 - 70/30-fold quantitative ratio, preferably 99.5 / 0.5 - 80/20, preferably 99 / 1 - 90/10, m=k+l, k/l= 80 / 20 - 20/80)



Polymer mixture come out of and shown ((A)/(B) = usually 99.9 / 0.1 - 70/30 (weight ratio) preferably 99.5 / 0.5 - 80/20, preferably 99 / 1 - 90/10, k=l+m, l/m= 25 / 75 - 75/25, p=q+r, q/r= 20 / 80 - 80/20)  
(In addition, \* mark shows optical-activity carbon)

\*\*\*\* is mentioned.

the logarithm which the molecular weight of these polymers is the various inside of a solvent, for example, a tetrahydrofuran, an acetone, a cyclohexanone, a phenol / tetrachloroethane (60/40) mixed solvent, and was measured at 30 degrees C -- for viscosity, the range of 0.05 to 3.0\*\* is 0.07 to 2.0 desirable still more preferably. a logarithm -- when viscosity is smaller than 0.05, the reinforcement of the obtained polymer liquid crystal becomes weak and is not desirable. Moreover, when larger than 3.0, problems, such as an increment in the time amount which the viscosity at the time of liquid crystal formation is too high, and a fall and orientation of a stacking tendency take, arise.

Next, it explains in more detail about the approach of forming a compensation layer on an orientation substrate. It is important to choose an orientation substrate according to the class of polymer liquid crystal used first. That is, it is not invaded by the solvent used in order to prepare a liquid crystallinity polymer solution, as mentioned above, but it is necessary to choose the orientation substrate which can bear the temperature when heat-treating. Moreover, since a compensation layer is exfoliated from this orientation substrate in a next imprint process, it is desirable to have moderate detachability.

Although already mentioned above as these orientation substrates, a film or a sheet of the polyimide which carried out direct rubbing in the example when using a polyester system liquid crystallinity giant molecule, for example, a polyether ether ketone, polyphenylene sulfide, and polyethylene terephthalate etc. satisfies these properties, and is desirable.

If it takes the case of solution mixing for an example in using the constituent which consists of a Manet Chick liquid crystallinity polymer and an optically active compound as a liquid crystallinity giant molecule, both components will be first dissolved in a solvent at a predetermined rate, and the solution of predetermined concentration will be prepared. Moreover, when using the optically active polymer which can twist in person instead of a liquid crystal polymer constituent, and shows a nematic stacking tendency, it dissolves in an independently predetermined solvent by predetermined concentration, and a solution is prepared. Although the solvents in this case therefore differ in the class of polymer, halogenated hydrocarbon, such as ether, such as ketones, such as an acetone, a methyl ethyl ketone, and a cyclohexanone, a tetrahydrofuran, and dioxane, chloroform, a dichloroethane, tetrachloroethane, a trichloroethylene, tetrachloroethylene, and an orthochromatic dichlorobenzene, the mixed solvent of these and a phenol, dimethylformamide, dimethylacetamide, dimethyl sulfoxide, etc. can usually be used. Although the concentration of a solution therefore differs greatly on the viscosity of a polymer, it is usually used in 5 to 50wt(s)%, and is 10 to 30% of range preferably. This solution is applied on an orientation

substrate next. As an applying method, a spin coat method, the roll coat method, the printing method, the curtain coat method, the immersion - - - - - ochralski method, etc. are employable. the solvent after spreading -- desiccation -- removing -- predetermined temperature -- predetermined time heat treatment -- carrying out -- mono--- domain torsion nematic orientation is completed. Although the one where the lower one of the viscosity of a polymer is good, therefore temperature is higher is desirable in the semantics which helps the orientation by the interface effectiveness, it causes increase of cost, and aggravation of workability and is not desirable if temperature is not much high. moreover, a polymer be alike seeds -- since an intermediary has an isotropic phase in the elevated-temperature section from a nematic phase, orientation is not obtained even if it heat-treats in this temperature region. It is desirable to heat-treat at the temperature below the transition point to an isotropic phase according to the property of the polymer above a glass transition point as mentioned above, generally the range of 50 to 300 degrees C is suitable, and the range of 100 to 250 degrees C is especially suitable. Although time amount required in order to obtain sufficient orientation in a liquid crystal condition on the orientation film therefore differs in the presentation of a polymer, and molecular weight and it cannot generally crawl on it to them, its range for 100 minutes is usually desirable from 10 seconds, and it is especially desirable from 30 seconds. [ of the range for 60 minutes ] The transparency of the compensating plate which is easy to become inadequate [ orientation ] when shorter than 10 seconds, and is obtained when longer than 100 minutes may fall. Moreover, after applying a polymer on an orientation substrate in the state of melting, therefore, \*\* and the same orientation condition can be acquired to carry out heat treatment. performing these processings using the polymer liquid crystal of this invention -- therefore -- first -- a liquid crystal condition -- the whole orientation substrate top surface -- a cotton intermediary -- uniform torsion nematic orientation can be obtained. Therefore, angle of torsion at this time or the direction of torsion can be prepared to adjust the class or amount of the class of optical-activity unit in a polymer and a ratio, or the optically active compound to mix.

In this way, therefore, it can fix to cool the acquired orientation condition to the temperature below the glass transition point of this liquid crystallinity macromolecule next, without spoiling orientation at all. When the \*\*\*\*\* polymer which generally has a crystal phase in the low-temperature section from a liquid crystal phase is used, therefore, it will break to cool the orientation in a liquid crystal condition. Without according to the approach of this invention, such a phenomenon arising, in order to use the polymer system which has a glass phase for the bottom of a liquid crystal phase, it can twist completely and nematic orientation can be fixed.

Especially a limit does not have a cooling rate and it is fixed only by taking out into the ambient atmosphere below a glass transition point out of a heating ambient atmosphere. Moreover, in order to raise the effectiveness of production, a line intermediary is also good in forced cooling, such as air cooling and water cooling. The thickness of the compensation layer after immobilization usually has the desirable range from 0.1 micrometers to 100 micrometers, and its range from 0.5 micrometers to 50 micrometers is especially desirable. If thickness is smaller than 0.1 micrometers, required angle of torsion and \*\*n-d will not be obtained, but uniform orientation becomes if it exceeds 100 micrometers, the effectiveness of the orientation film will also become weak and will be hard to be obtained.

In order for the compensating plate of this invention to demonstrate sufficient compensation effect and to obtain high monochrome display of quality, strict control of the optical parameter of this compensation layer is important, and it is required for nothing and its angle of torsion to be in the range of 70 to 300 degrees, and for product \*\*n-d of membranous birefringence \*\*n and Thickness d which consists of this liquid crystallinity macromolecule to be in the range of 0.1 to 3.0 micrometers about the helical structure to which the molecule which constitutes a compensation layer has a screw axis to a substrate and a perpendicular direction. The range of 0.3 to 1.2 micrometers is [ 170 degrees to 280 degrees, and \*\*n-d ] preferably [ usually / from 0.1 / 1.5 micrometers ] usually desirable [ angle of torsion ], when 80 degrees to 120 degrees and \*\*n-d usually have the range usually preferably desirable [ angle of torsion ] in especially for TFT of 0.2 to 3.0 micrometers, and 0.3 to 2.8 micrometers 150 degrees from 70 degrees and it is an object for STN preferably 300 degrees from 150 degrees. When there is no value of angle of torsion and \*\*n-d in this range, the color compensation effect made into the purpose is inadequate, and satisfying monochrome display is not obtained. the approach which described above the constituent which blended the optically active compound of the amount mentioned above on the above-mentioned orientation substrate in order for the molecule which constitutes a compensation layer to take the helical structure which has a screw axis to a substrate and a perpendicular direction and to have required angle of torsion and \*\*n-d to the liquid-crystallinity giant molecule of the base, or the liquid-crystallinity giant molecule which has in intramolecular the optical-activity radical of a ratio mentioned above -- orientation -- fixing -- predetermined thickness -- then, it is good

Next, an imprint process is explained. First, the compensation layer on the orientation substrate obtained in this way and other translucency substrates are stuck using adhesives or a binder. Next, a \*\*\*\* [ layer / compensation ] substrate is exfoliated in the interface of an orientation substrate and a compensation layer, a compensation layer is imprinted to a translucency substrate side, and the compensating plate for liquid crystal display components of this invention is manufactured.

As an example of the translucency substrate used, the plastic film which has translucency and the optical isotropy is mentioned. For example, polymethylmethacrylate, polystyrene, a polycarbonate, polyether sulfone, polyphenylene sulfide, polyarylate, amorphous polyolefine, triacetyl cellulose, or an epoxy resin can be used. Polymethylmethacrylate, a polycarbonate, polyether sulphone, polyarylate, amorphous polyolefine, etc. are used preferably especially. Moreover, a polarization film can be illustrated as class with the another translucency substrate used. It is an optical element indispensable to a liquid crystal display, and if a polarization film is used as a translucency substrate, a polarization film can be used as the optical element with which the compensation layer and the polarization film were united, and is very convenient. Moreover, the liquid crystal display cel itself can be mentioned as an example of the translucency substrate used by this invention. If the liquid crystal cell uses the glass substrate with an electrode of two upper and lower sides and imprints a compensation layer on one of these upper and lower sides, or double-sided glass, the substrate glass of a display cel itself will serve as a compensating plate.

Although there will be especially no limit if the adhesives or the binder which sticks a translucency substrate and a compensation layer is the thing of optical grade, acrylic, an epoxy system, an ethylene-vinyl acetate copolymer system, a rubber system, etc. can be used.

The imprint to the translucency substrate of a compensation layer can perform the orientation substrate after adhesion by exfoliating in an interface with a compensation layer. The approach of exfoliation can illustrate the approach of carrying out dissolution removal of the orientation film on the approach of exfoliating mechanically, the approach of applying a supersonic wave and exfoliating in a poor solvent, the approach of giving a temperature change and exfoliating using the difference of the coefficient of thermal expansion of an orientation substrate and a compensation layer, the orientation substrate itself, or an orientation substrate etc., after being immersed in the approach of exfoliating mechanically using a roll etc., and the poor solvent to all components. Since detachability therefore differs in the adhesion of the polymer liquid crystal and orientation substrate to be used, it should adopt the approach which was most suitable for the system.

Thus, the compensating plate for liquid crystal display components of this invention which consists of the three-tiered structure of a compensation layer, a binder (adhesives) layer, and a translucency substrate is manufactured. This compensating plate may remain as it is, may be used, and may prepare the protective layer of a transparent plastic for a surface protection. Moreover, you may use it in the form combined with other optical elements, such as a polarization film.

The compensating plate for liquid crystal display components therefore manufactured by the manufacture approach of this invention as mentioned above has not only enabling perfect monochrome display but thin cost at a low price, and it is light. The very industrial value which the width of face of selection of a translucency substrate can use as the compensating plate of very large various engine performance and a gestalt, and can furthermore apply to a STN liquid crystal display, a TFT-liquid-crystal display, etc. is big. (Example)

Although an example is described below, this invention is not restricted to these. In addition, each analysis method used in the example is as follows.

(1) Decision of a presentation of a polymer The polymer was dissolved in deuterium chloroform or deuterium trifluoroacetic acid, and it measured and determined by 400MHz 1 H-NMR (JEOL JNM-GX400).

(2) a logarithm -- measurement of viscosity It measured at 30 degrees C using the Ubbelohde viscometer among the phenol / tetrachloroethane (60/40-fold quantitative ratio) mixed solvent.

(3) Decision of a liquid crystal phase sequence DSC (DuPont 990 Thermal Analyzer) measurement and optical microscope (BH2 made from Olympus Optics polarization microscope) observation determined.

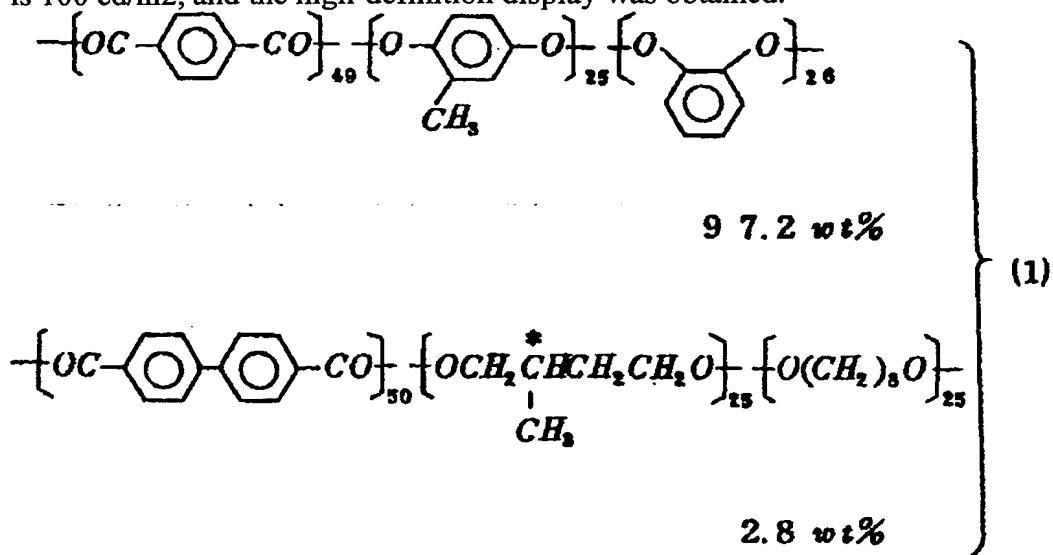
(4) Decision of angle of torsion and \*\*n-d Analysis processing was carried out and the data which measured angle of torsion with polarization analysis, and measured \*\*n-d by the ellipsometer were determined.

Example 1. 15wt(s)% the phenol / tetrachloroethane (60/40-fold quantitative ratio) solution containing the mixed polymer (the logarithm of a base polymer viscosity 0.18, Tg= 95 degrees C, the logarithm of optically active polymer viscosity 0.13) shown by (1) formula were prepared. It dried, after thickness used and carried out the cast of the screen printer in 15cmx23cm magnitude on the polyimide film which is 125 micrometers and which carried out rubbing processing using this solution, heat treatment was performed for 200 degree-Cx 40 minutes, and next it cooled and fixed. Angle of torsion of this compensation layer is -231 degrees,

\*\*n-d is 0.84 micrometers, and it is \*\*\*\*\*. On this compensation layer, acrylivesives were used and the polyether sulfone film whose thickness is 100 micrometers in 15cmx23cm magnitude was stuck. Next, the interface of a polyimide film and a compensation layer was calmly torn off using the roll.

In this way, according to the arrangement which shows the produced compensating plate in Fig. 2, angle of torsion of 1 / 200 duty drives has arranged 230 degrees and \*\*n-d on the top face of a 0.87-micrometer STN liquid crystal cell, stuck the polarizing plate on it further, and the liquid crystal cell was produced. The direction of the vertical polarizing plate in this case, the direction of rubbing of a vertical electrode substrate, and the direction of orientation of the molecule of a compensation layer are as being shown in Fig. 3. The include angle at which the transparency shaft of the direction of orientation of the molecule of the field which touches the upper polarizing plate of 90 degrees and a compensation layer, and an upper polarizing plate makes the include angle with the direction of orientation of the molecule of the field where the include angle at which the direction of rubbing of 90 degrees, a bottom polarizing plate, and a bottom electrode substrate makes the include angle which the polarization shaft of a vertical polarizing plate makes touches 45 degrees, the direction of upper electrode substrate rubbing, and the upper electrode substrate of a compensation layer to make is 45 degrees.

The foreground color of this liquid crystal cell was perfect black and white, a contrast ratio is 60, brightness is 100 cd/m<sup>2</sup>, and the high-definition display was obtained.



\*印は光学活性炭素を示す。

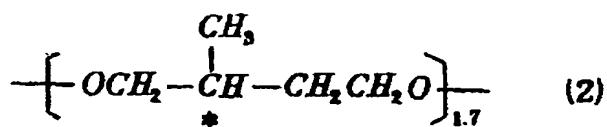
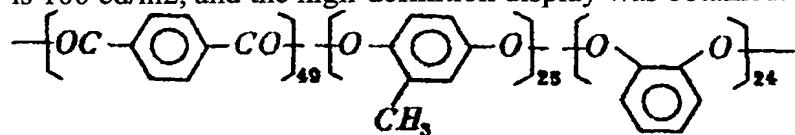
Example 2. 16wt(s)% the phenol / tetrachloroethane (60/40-fold quantitative ratio) solution containing the mixed polymer (the logarithm of a base polymer viscosity 0.18, Tg= 95 degrees C, the logarithm of optically active polymer viscosity 0.13) shown by (1) were prepared. It dried, after thickness used and carried out the cast of the screen printer in 15cmx23cm magnitude using this solution on the polyether ether ketone film which is 50 micrometers and which carried out RAHINGU processing, heat treatment was performed for 200 degree-Cx 45 minutes, and next it cooled and fixed. Angle of torsion of this compensation layer is -230 degrees, \*\*n-d is 0.84 micrometers, and it is \*\*\*\*\*. On this compensation layer, the polarization film with a binder whose thickness is 120 micrometers was stuck in 15cmx23cm magnitude. At this time, the include angle of the transparency shaft of a polarization film and the direction of rubbing of an orientation substrate to make was stuck so that it might become 5 times. Next, it pulled up, after immersing this into the hexane and irradiating a supersonic wave for 5 minutes, and the orientation substrate and the compensation layer were torn off calmly. A test cell is made for each optical axis in an assembly and that case to become arrangement of Fig. 3 by the 2nd arrangement (for the compensating plate of 22 of Fig. 2 to be the compensation layer itself in this example), and the compensation effect as well as an example 1 was investigated so that the compensation layer of this compensating plate with a polarization film might be on a liquid crystal cell side. The foreground color of this liquid crystal cell was perfect black and white, a contrast ratio is 65, brightness is 105 cd/m<sup>2</sup>, and the high-definition display was obtained.

Example 3. The 20wt% tetrachloroethane solution of the optically active polymer (logarithm viscosity 0.15, Tg= 81 degrees C) of a formula (2) was adjusted. Independently, the polyvinyl alcohol water solution was applied on the stainless steel plate whose thickness is 2mm and which carried out surface polish, after

rubbing processing was dried and carried out in 15cmx23cm magnitude, and the orientation substrate was produced. After applying the polymer solution with the spin coat method and drying besides, heat treatment was performed at 180 degrees C for 40 minutes, then cooling immobilization was carried out, and the compensation layer was formed. Angle of torsion of this compensation layer is -228 degrees, \*\*n-d is 0.835 micrometers, and it is \*\*\*\*\*.

On this compensation layer, the polycarbonate film with a binder whose thickness is 120 micrometers was stuck in 15cmx23cm magnitude. After this was immersed underwater for 1 hour, underwater, the interface of an orientation substrate and a compensation layer was torn off calmly, and it dried. A test cell is made for each optical axis in an assembly and that case to become arrangement of Fig. 3 by arrangement of Fig. 2 , as the compensation layer of this compensating plate is on a liquid crystal cell side, and the compensation effect as well as an example 1 was investigated.

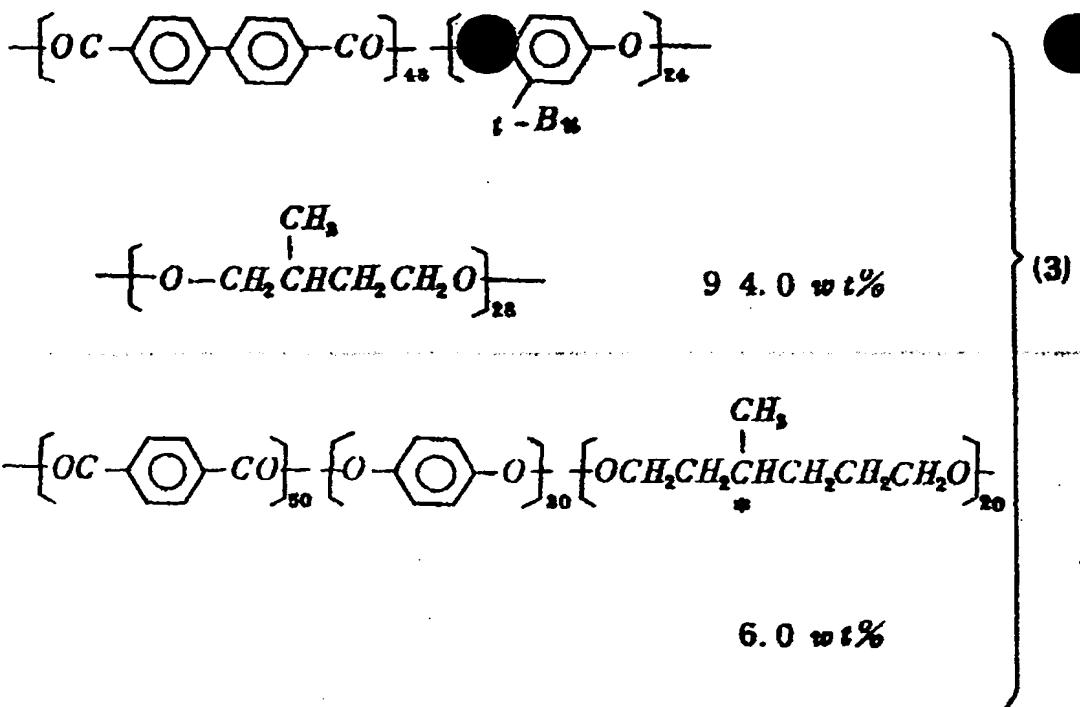
The foreground color of this liquid crystal cell was perfect black and white, a contrast ratio is 59, brightness is 100 cd/m<sup>2</sup>, and the high-definition display was obtained.



Example 4. The 20wt% dimethyl formamide solution of the mixed polymer (the logarithm of a base polymer viscosity 0.21, Tg= 60 degrees C, the logarithm of optically active polymer viscosity 0.18) of a formula (3) was adjusted. Direct rubbing processing of the polyether ether ketone sheet whose thickness is 5mm and which carried out surface polish was independently carried out in 15cmx23cm magnitude, and the orientation substrate was produced. After applying the polymer solution with the spin coat method and drying besides, heat treatment was performed at 150 degrees C for 20 minutes, then cooling immobilization was carried out, and the compensation layer was formed. Angle of torsion of this compensation layer is -229 degrees, \*\*n-d is 0.843 micrometers, and it is \*\*\*\*\*.

On this compensation layer, the triacetyl cellulose film with a binder whose thickness is 120 micrometers was stuck in 15cmx23cm magnitude. After leaving it for 1 hour, the interface of an orientation substrate and a compensation layer was calmly torn off using the roll. A test cell is made for each optical axis in an assembly and that case to become arrangement of Fig. 3 by arrangement of Fig. 2 , as the compensation layer of this compensating plate is on a liquid crystal cell side, and the compensation effect as well as an example 1 was investigated.

The foreground color of this liquid crystal cell was perfect black and white, a contrast ratio is 61, brightness is 105 cd/m<sup>2</sup>, and the high-definition display was obtained.

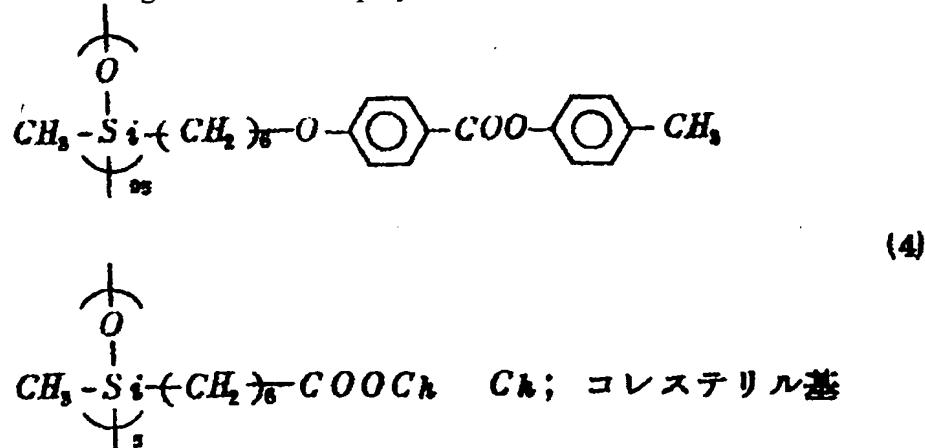


\*印は光学活性炭素を示す。

Example 5. The optically active polymer [ of a formula (4) / 18wt(s)% of ] (logarithm viscosity 0.23) trichloroethane solution was adjusted. Direct rubbing processing of the polyethylene terephthalate film whose thickness is 80 micrometers was independently carried out in 15cmx23cm magnitude, and the orientation substrate was produced. After applying the polymer solution by the curtain coat method and drying besides, heat treatment was performed at 100 degrees C for 20 minutes, then cooling immobilization was carried out, and the compensation layer was formed. Angle of torsion of this compensation layer is -227 degrees, \*\*n-d is 0.83 micrometers, and it is \*\*\*\*\*.

On this compensation layer, the polyether sulfone film with adhesion whose thickness is 120 micrometers was stuck in 15cmx23cm magnitude. After \*\*\*\*\* (ing) this at -15 degrees C for 1 hour, the interface of an orientation substrate and a compensation layer was torn off calmly quickly.

A test cell is made for each optical axis in an assembly and that case to become arrangement of a 3rd [ \*\* ] Fig. R > Fig. by arrangement of Fig. 2, as the compensation layer of this compensating plate is on a liquid crystal cell side, and the compensation effect as well as an example 1 was investigated. The foreground color of this liquid crystal cell was perfect black and white, a contrast ratio is 58, brightness is 100 cd/m<sup>2</sup>, and the high-definition display was obtained.



Example 6. 15wt(s)% the phenol / tetrachloroethane (60/40-fold quantitative ratio) solution containing the mixed polymer (the logarithm of a base polymer viscosity 0.18, the logarithm of optically active polymer

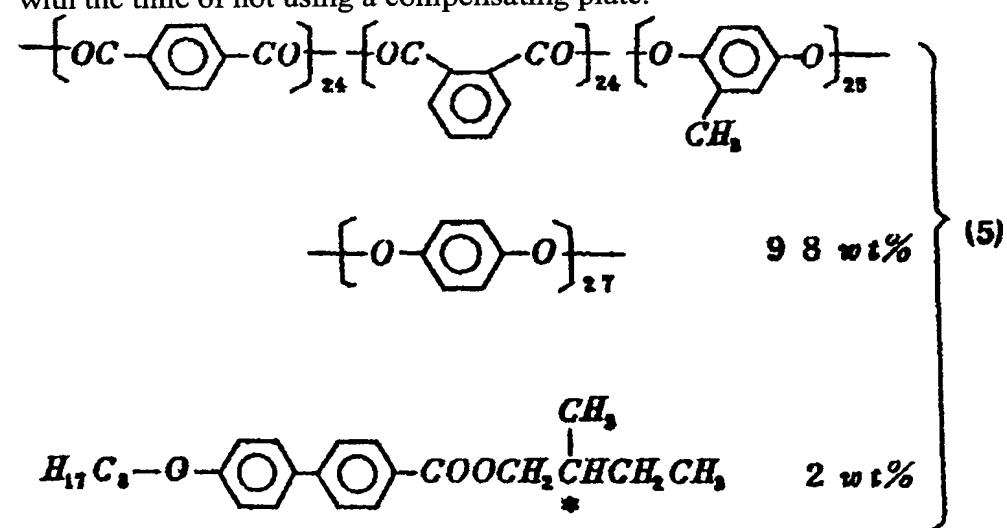
viscosity 0.13) shown by (1) formula were prepared. It dried, after thickness used and carried out the cast of the screen printer in 15cmx23cm magnitude using this solution on the polyether ether ketone film which is 50 micrometers and which carried out rubbing processing, heat treatment was performed for 200 degree-Cx 40 minutes, and next it cooled and fixed. Angle of torsion of this compensation layer is -230 degrees, \*\*n-d is 0.84 micrometers, and it is \*\*\*\*\*.

Next, the binder was applied to homogeneity on the top-face glass of the STN liquid crystal cell used in the example 1. It is \*\*\*\*\* as the field of a compensation layer touches a binder layer in the polyether ether ketone film with a compensation layer produced on this binder layer. Only the polyether ether ketone film after 1-hour neglect was lengthened calmly, and was removed, the compensation layer was imprinted on liquid crystal cell top-face glass, and the polarization film was further stuck on it. Each optical axis in this case was set up as shown in Fig. 3. In this way, as for the display of the produced test cell, completely colorless and beautiful monochrome display was obtained.

Example 7. (formula 5) The 15wt% phenol tetrachloroethane solution of the shown mixed polymer (the logarithm of a base polymer viscosity 0.18, Tg= 72 degrees C) was adjusted. This solution was applied with the spin coat method using the polyimide sheet in which 10cmx10cm magnitude carried out direct rubbing as an orientation substrate. After spreading and desiccation, at 150 degrees C, it heat-treated for 30 minutes, cooling immobilization was carried out, and the compensation layer was formed. Angle of torsion of a compensation layer is -90 degrees, \*\*n-d is 0.52 micrometers, and it is \*\*\*\*\*.

On this compensation layer, the interface of after \*\*\*\*\* a polyimide film, and a compensation layer was calmly exfoliated in the polarization film with adhesion, and the compensation layer was imprinted at the polarization film side.

Next, on 90 angle of torsion and the Twisted Nematic (TN) liquid crystal cell of \*\*n-d0.52micrometer, as the compensation layer was on the cel side, it has arranged this compensating plate. Under the present circumstances, it was made for the include angle which the polarization film which are two upper and lower sides makes [ the include angle at which the direction of orientation of the molecule of the field which touches the upper electrode substrate of the direction of rubbing of a liquid crystal cell top electrode substrate and a compensation layer makes a setup of each optical axis ] 90 degrees to turn into 0 times. As a result of investigating the compensation effect of this test cell, far perfect black was obtained compared with the time of not using a compensating plate.



\* 即は光学活性炭素を示す。

#### (Effect of the invention)

Since the manufacturing method of the compensating plate for liquid crystal display components of this invention separated the orientation substrate, the translucency substrate, and the role, the width of face of selection of a substrate can manufacture the compensating plate of breadth, various engine performance, and a gestalt sharply, and it is very useful to thin-shape[ high-performance-izing of various liquid crystal displays, such as TFT and a STN type, lightweight-izing and J-izing, and low-cost-izing. [ of width of face ]

[Translation done.]

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CLAIMS

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(57) [Claim(s)]

[Claim 1] The manufacturing method of the compensating plate for liquid crystal display components characterized by imprinting the layer which consists of the liquid crystallinity macromolecule formed on the orientation substrate on a translucency substrate.

[Claim 2] The manufacturing method given in the 1st term of a claim which a liquid crystallinity giant molecule can twist in the state of liquid crystal, carries out nematic orientation, and is characterized by being the liquid crystallinity giant molecule which will be in a vitreous state at the temperature below the liquid crystal transition point.

[Claim 3] The manufacturing method given in the 1st term of a claim characterized by a translucency substrate being plastic film.

[Claim 4] The manufacturing method given in the 1st term of a claim characterized by a translucency substrate being a polarization film.

[Claim 5] The manufacturing method given in the 1st term of a claim characterized by a translucency substrate being a glass substrate of the top face of a liquid crystal display cel, or/and an inferior surface of tongue.

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[Translation done.]

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